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VAGINAL SMEARS CORRELATED TO OVARIAN FUNCTION

(4½ Months Fetus Through Puberty)

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AFTER a study of the vaginal changes which characterize the prepubescent, one may better understand the metabolic changes in the maturer phases of a woman's life. Prepubescent females are but prototypes of the adults. Many texts state that the growing fetus is dependent upon its parent's many vital organs, but research has taught us more about the independence of the fetus, as for example, the actions of the liver and spleen. Now, the purpose of this article is to clarify our present day knowledge concerning the degrees of ovarian function clinically demonstrable in the human female fetus and the resultant child. We know nothing about the gonadal influence in the male fetus. We believe firmly that all physicians will find the vaginal smear method an aid to the proper diagnosis of many conditions which are now considered out of the realm of gynecology.

The ovary, which arises from a strip of thickened mesodermal[1] epithelium on the surface of the urogenital fold, presents and produces marked histologic changes during its anaphase and cataphase. The anaphase in the ovary is characterized by the manufacture of folliculin by those follicular cells which are next in line for ovulation. The elaboration of the folliculin produces a cyst. The cataphase commences with ovulation and is characterized by the forma-

Dr. Russell, on leave from the University of Tennessee, started collaborating with Dr. Bennett in May, 1940.

tion of a hematoma in the ruptured follicles. Later, there appears a fibroma and an ultimate interstitial oophoritis[2]. The cells entering into the cataphasic phenomena are theca lutein cells found to contain cholesterol esters and doubly refracting lipoids. Follicular lutein cells contain lipoids of the phosphatide and cerebroside type and a lutein that is like the carotins, chemically. Hormonal elaboration of a part of these cells continues until the formation of the interstitial oophoritis.

VAGINAL SMEARS

Ovarian Hormonal Stimulation

Maximum pH	Follicular (ovulation) 6 to 5	Luteal (premenstrual) 4.5 to 3
Bacteria	Clumps of gram negative cocci.	Myriads gram positive cocci and bacilli (Döderlein).
Erythrocytes	May be found occasionally.	May be an occasional.
Leukocytes	Puffed with gram negative nuclei.	Polar, gram positive nuclei. Some young forms.
	Epithelial Cells	
Size and Shape	Large with well defined cell outline in mosaic pattern.	Thin, twisted and clumped.
Cytoplasm	Noncornified. Many fine gram negative granules.	Partly or completely cornified. Shredding. Many agranular and with vacuoles.
Nuclei	Small, oval or round and gram negative with many coarse gram positive granules.	Many free or absent. Large, ovoid and gram negative. Occasional gram positive granules.

The typical anaphase effect upon the vagina is a marked hypertrophy of the mucosa. The cataphase is characterized by an atrophy of the vaginal mucosa. It has been shown that the vaginal mucosa can be differentiated into distinct layers of cells, authors differing as to the exact number. Three layers seem to be the most acceptable for practical clinical purposes, i. e., the basal, intermediary and the superficial. The vaginal mucosa is thicker when the hydrogen-ion concentration is increased, and this is the direct result of estrogenic stimulation, as demonstrated by Weinstein and Howard[3]. Vaginal smears can be used as an index of the amount of follicular or luteal stimulation in any female (see table above).

TECHNIC AND INTERPRETATION

The patient is instructed as follows: A sterile cotton-tipped applicator is to be moistened with tap or distilled water and inserted

just within the introitus. A gentle rotary motion procures the specimen which is to be rolled upon a clean slide and the material is allowed to dry at room temperature without fixation. The slide is to be labeled with the name and date before sealing in an envelope. This method of obtaining the smear is different and much simpler than those described by others, but approximately 15,000 slides have been examined in this clinic since 1935 and the results are as reliable as the fixation method, which was discontinued a few years ago. Papanicolaou's[4] staining technic and the modification of his method by Shorr[5] are more tedious than a modification of Gram's method, whereby each stain is used for two minutes, with carbolfuchsin for the counterstain. We prefer to use Giemsa's staining method without fixation, and double the strength recommended for blood smears. The cornified cells stain red, the moderately cornified stain violet, and the uncornified epithelial cells appear blue. The erythrocytes, bacteria, nuclear material and leukocytes become a profusion of colors.

Discussion

The vaginal smear of the pregnant woman at 18 weeks contains many types of bacteria accompanying a luteal domination. However, the smear from her 18 week fetus shows that there is only follicular stimulation (fig. 1). This finding suggests that the ovaries of the fetus have begun to function and are practically independent of further maternal influence. The 7 lunar month fetus (28 weeks) continues to exhibit a follicular stimulation, but there is a reversal in the maternal vaginal picture as compared to the above, because her smear now shows a predominant follicular influence (fig. 2). Further proof of this stimulation can be had by histologic sections which show a thickening of the vaginal mucosa. Smears from a full term baby and the mother on the day of birth give evidence of a like hormonal influence, that of follicular stimulation (fig. 3). Daily smears taken from the full term newborn give proof that the follicular stimulation gradually decreases until there is no evidence of it by the time the baby is 94 days old (fig. 4).

The portal of entry in the newborn is of great importance in cases of pyelitis and similar diseases. Infections and intracranial damage to the premature infant are the most frequent causes of a high mortality in those patients. As stated, the bacteria in the maternal vagina are greater in number and more varied in type during the time that the luteal stimulation predominates, and these decrease in number and types in the normal individual up to the time of a full term delivery, when there are few in comparison. One of

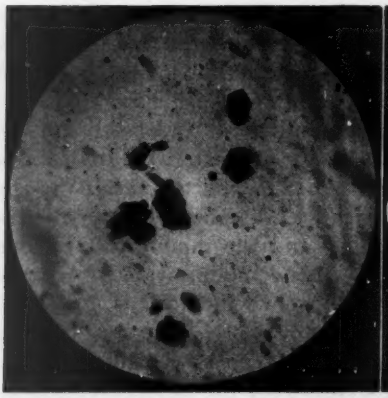

Fig. 1

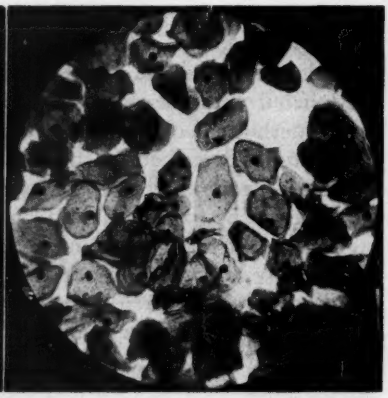

Fig. 2

VAGINAL SMEARS

Fig.	Age	Bact.	R.B.C.	Leuk.	Epithelial Cells		Diagnosis	
					Type & Cytoplasm	Nucleus	Baby	Mother
1	4½ mos. fetus	None	Many. (due to tear.)	Very occ.	Single intermediary as rule but occ. clusters. Many coarse granules.	Small and round. Granules: coarse and gram + Nucleoplasm: gram —	Follicular only.	Strong luteal.
2	7 mos. fetus	None	None	None	Superficial and intermediary in mosaic pattern. Edges rolled and fine granules in cytoplasm.	Variable size and shape. Granules: fine and gram + Nucleoplasm: gram —	Very strong follicular.	Follicular stronger (result of labor).

the plausible reasons of the high incident of infections in the premature newborn may be attributable to the above facts, because these babies are born during the luteal domination period and they are not as well prepared for their new environment as the full term baby. It is important to note that no bacteria are found in the vaginal smears from either fetus or baby until the newborns have been exposed to a new environment.

It is interesting to note the following data on a normal pregnant female at term, which were taken from the files; the estrogenic determination of the placental blood (taken from the cord) was 1.167 mg.; mother's blood from cubital vein was 0.19 mg.; and the blood

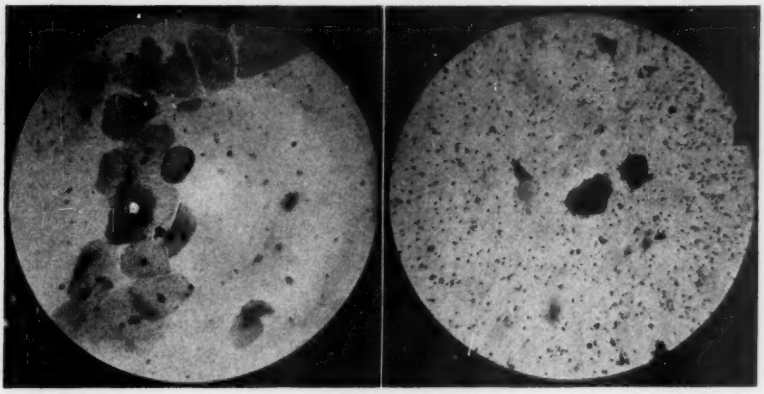

Fig. 3 Fig. 4

VAGINAL SMEARS

Fig.	Age	Bact.	R.B.C.	Leuk.	Epithelial Cells		Diagnosis	
					Type & Cytoplasm	Nucleus	Baby	Mother
3	(Term) 10 mos.	None	None	None	Superficial arranged in mosaic pattern. Shape varies. Fine and coarse granules.	Variable shape and size. Granules: coarse and gram + Nucleoplasm: gram —	Strong folliicular.	Strong follicular.
4	94 days after del.	Gram+ (Döder.) bac. and cocci.	None	None	Superficial and intermediary with irregular outline. Cytoplasm with fine gram — granules.	Small or absent. Granules: few gram+ and coarse. Nucleoplasm: gram —	No follicular but typical of luteal domination.	Menses (follicular).

oozing from the uterine cavity was 0.137 mg. All specimens were recovered at the time of cesarean section and calculated as of 1000 cc. blood, by a modification of the Frank and Goldberger[6] method. These chemical data substantiate the vaginal smear findings that the parent does not control the ovarian functions of the fetus. Some believe that the nursing baby's ovaries are influenced by the hormones in maternal milk, but the influence is negligible as exemplified by figs. 5 and 6, which are photomicrographs of smears from the mother and baby 220 days after delivery. There may be a slight activating stimulus, but our postulation seems to have been proved following the study of a large number of these slides.

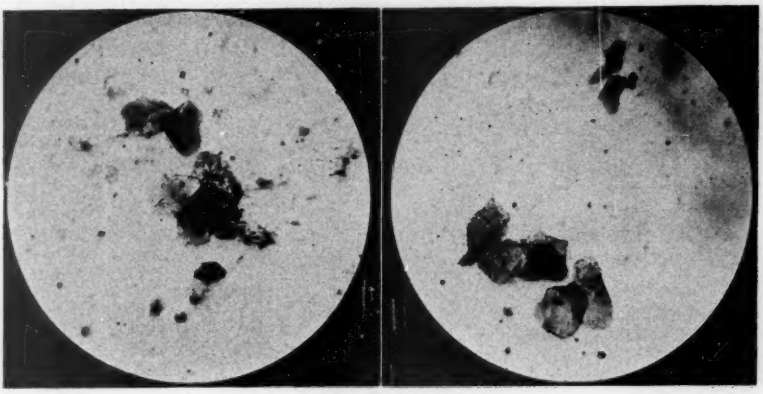

Fig. 5 Fig. 6

VAGINAL SMEARS

Fig.	Age	Bacteria	R.B.C.	Leuk.	Epithelial Cells: Type & Cytoplasm	Epithelial Cells: Nucleus	Ovarian Stimulation: Mother	Ovarian Stimulation: Baby
5	Baby 220 days of life.	Some gram — and occ. gram +	None	Some poly.	All types. Numerous basal. Irregular shapes. Shredded or curled edges.	Many absent or free. Large and round. Many vacuoles. Stain poorly.	Follicular.	Luteal.
6	Mother 220 days after del.	Many. Some clumped. Gram — cocci, etc.	Maybe very occ.	Few older forms.	All types but occ. basal. Some with ingested bacteria. Moderate or no cornification. Granules fine and coarse, no vacuoles.	Size varies Oval or round. Coarse gram + granules, no vacuoles.	Follicular. 1 week post menstrual.	Luteal.

The follicular and luteal predominance recur at a definite cyclic period through the remainder of the normal individual's life until those changes which take place as the result of the menopause, whether it be physiologic or artificial. We have chosen a normal 8 year old girl to demonstrate the results of the aforementioned observations because space does not permit the reproduction of photomicrographs for all ages. One may see that there is a cycle of 24 days from the day of "congestion," which simulates menstruation in the adult (figs. 7 to 10, inclusive). The child's parents are living

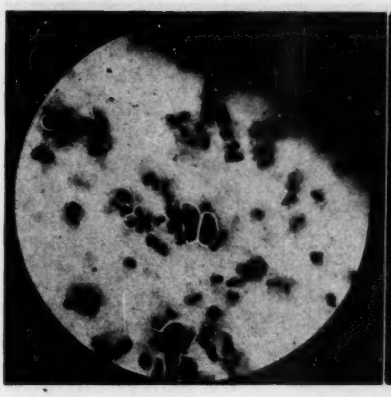

Fig. 7

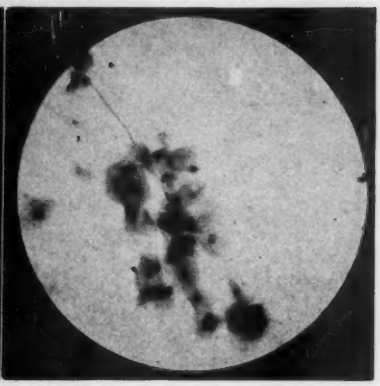

Fig. 8

VAGINAL SMEARS OF 8 YEAR OLD (INTERVALS OF 1 WEEK)

Fig.	Date	Bacteria	R.B.C.	Leukocytes	Epithelial Cells: Type & Cytoplasm	Epithelial Cells: Nucleus	Ovarian Stimulation
7	8/24/39	Few clusters of gram + and gram + cocci.	Occasional microblast	Myelocytes and large poly.	Well defined basal and intermediary. Fine granules and some cells with vacuoles.	Varying size and shape, many free. Granules: gram + and fine. Nucleoplasm: gram —	Hyperemia or follicular.
8	8/30/39	Occ. gram + and gram — cocci.	None.	None	Intermediary cells with minute vacuoles and most of edges rolled. Fine granules are gram negative.	Large and same as above but with vacuoles.	Luteal domination of a strong follicular.

and well with no familial diseases; she has an older brother; she was a full term baby delivered spontaneously; no serious illnesses; all reproductive organs were considered normal at the time of an appendectomy and are normal to palpation per rectum at present. She is a normal child in every respect.

Of course, abnormal ovarian conditions would alter this cyclic pattern and an article concerning those cases will be published at an early date. However, we may mention here that it seems an easy matter to predict the cycle of the mature female and diagnose ab-

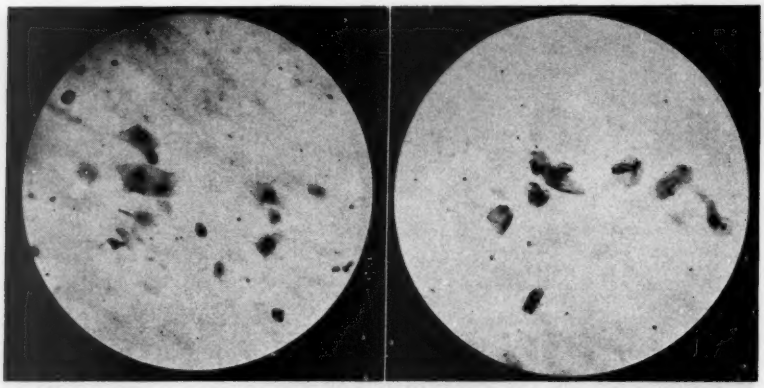

Fig. 9 Fig. 10

VAGINAL SMEARS

Fig.	Age	Bact.	R.B.C.	Leuk.	Epithelial Cells Type & Cytoplasm	Epithelial Cells Nucleus	Diagnosis Baby	Diagnosis Mother
9	9/6/39	Fewer.	None.		Occasional poly.	Well defined intermediary with more granules in a thicker cytoplasm and no vacuoles.	Large oval or round. Occ. free nucleus. Granules: fine. Nucleoplasm: gram —	Same with less follicular.
10	9/13/39	Some gram + cocci.	None.		None	Superficial and intermediary not grouped. Irregular outline and twisted or folded cytoplasm and agranular. Cornified.	Most absent. Agranular. Nucleoplasm: gram — with vacuoles.	No follicular. Strong luteal.

9/16/39 Return of "congestive" picture as of 8/24/39 (24 days cycle, inclusive)

normal ovarian conditions by studying the vaginal smears of the young female previous to the onset of the menses or puberty. Striking examples of pathologic ovarian conditions in the child are: (1) the prepubescents who menstruate; (2) the child mothers; and, (3) perhaps the baby who menstruates due to too strong an estrogenic stimulation. Medicolegal questions demanding the proof of criminal assault are most difficult many times and the vaginal smear could be used in furthering such questionable diagnosis. Trauma can be

diagnosed readily and we have found spermatozoa in the vagina when the smear was made two days after coitus. The masturbating female has been detected by vaginal smears although she was not suspected by her parents, but the diagnosis was corroborated by her admission.

SUMMARY

Numerous practical applications of the smear method for diagnosis can be made where all previous efforts might have failed. The best way to study the individual is to have her make a daily smear for one month before the physician can justify his diagnosis of the existing pathologic condition. Of course, biologic assays, blood chemistries, and the specific dynamic action test must be correlated with the vaginal smear findings in order to classify properly the fractional gradations of the patient's pathologic conditions. Toxemias, abortions and other patients who have luteal domination with a constant bacterial level throughout pregnancy will be discussed in an early article, but, suffice it to mention here, the maternal ovaries play a most important part upon the incidence of premature births.

CONCLUSIONS

1. The vaginal smear method can be used to determine the state of ovarian metabolism in the human.
2. The ovarian metabolism of the fetus is independent of maternal influence.
3. The prepubescent and mature ovarian states are comparable.
4. The therapy indicated is governed by the vaginal smear findings and the biologic studies.

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INTESTINAL INTUBATION

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THE history of intestinal intubation like that of most useful clinical procedures goes back many years and beautifully illustrates the tremendous benefit that mankind has gained from animal experimentation. It shows how a keen observer possessed of certain knowledge accumulated by others over many years while watching a rather simple experiment upon animals can catch the full significance of the experiment and translate it into a method which we as clinicians can use in our everyday work. Someone has said that the plaything of the laboratory may some day be the useful instrument of the bedside and surely no clearer demonstration of that may be had than in tracing the development of intubation of the small intestine. The history of intubation also teaches us that facts learned in the experimental laboratory may sometime wait years before being brought to the clinic and bedside. The distance from experimental laboratory to bedside should be short indeed but often too much time is required for its travel.

Alexander Monro II of Edinburgh was probably the first to introduce a tube through the esophagus to the stomach. This he did in 1767 employing a flexible tube of coiled wire covered with leather to remove fermenting fluids and gases from the stomachs of cattle. One hundred years later Kussmaul employed a large stomach tube for performing gastric lavage and he was probably the first to use the method upon human beings.

Scheltema in 1908 was the first to pass a tube into the intestines. In animals he was able to pass a small tube through the entire tract and remove it per anum. He also passed the tube a few times into the intestinal tracts of humans. In 1909 Gross and Einhorn devised tubes for passage into the duodenum. Sometime after 1909 Einhorn devised a jointed small tube which would reach the cecum but required three to seven days to do so.

Westerman in 1910 and Kappis in 1911 practiced continuous siphon drainage of the stomach by means of a small tube passed through the nose. As early as 1916 Kanavel suggested that closed suction systems in place of siphonage be used with such tubes. Paine[9] cites the following items of historical interest:

> The application of continuous suction to duodenal tubes originated with Ward, of San Francisco, in 1925. In 1929 he described his suction method of treatment for acute general peritonitis and in 1930 he described the application of the same method for the treatment of acute dilatation of the stomach.

In 1931 Wangensteen reported the use of suction applied to inlying duodenal tubes to relieve the distention accompanying certain types of intestinal obstruction and found that in many such cases operative intervention was not needed. Wangensteen and I in 1933 showed that duodenal tubes draining the upper part of the gastro-intestinal tract were much less efficient when allowed to act as siphons than when constant suction was maintained.[9]

Intestinal intubation as practiced today is almost entirely due to the efforts of T. Grier Miller and William Osler Abbott of Philadelphia and Charles G. Johnston of Detroit. Using their observations and studies for material these gentlemen have published a number of papers which have led to the widespread adoption of the method. In 1932 while watching Abbott make kymographic tracing of jejunal action by means of a tube with attached balloon, Miller heard him speak of the difficulty of preventing the balloon from slipping down the bowel. The thought occurred to Miller that a similar arrangement might be used to carry another attached and open tube to lower levels.

Meantime it was appreciated that Chester Jones had used a tube with attached balloon for a study of pain in the intestine and that Alvarez had observed that a balloon introduced by fistula tended to pass down the tract with peristaltic waves. The attachment of another open tube to the tube with a balloon was tried and in some instances was successful, but two tubes of sufficient calibre were quite disturbing to the subject. Likewise an apparatus consisting of two tubes within a single larger tube of thin rubber, such as Castle used in some work on the duodenum, was difficult to construct and equally difficult for the subject to swallow. We had sufficient success with such types of apparatus, however, to realize the feasibility of the method and next undertook to secure a single double-lumened tube of sufficient length to reach the ileum and of reasonable flexibility. We soon found that such a rubber tube had never been manufactured and that its construction was not considered possible. In spite of that, one of the commercial organizations agreed to experiment on the matter and succeeded in producing, by the extrusion process, the double-lumened tube that we have since used.[13]

Miller and Abbott passed the tube in dispensary patients and paid volunteers and through their studies of the chemistry and bacteriology of the secretions obtained they have made important contributions to the physiology and pharmacology of the gastro-intestinal tract. Abbott alone has performed several hundred intubations. No doubt more investigations will be made and they will almost certainly be helpful in the diagnosis and treatment of obscure metabolic with gastrointestinal disorders.

At the time Miller and Abbott were doing their investigations in the experimental laboratory and medical clinic, Charles G. Johnston was connected with the surgical staff of the same institution (Hospital of the University of Pennsylvania). Johnston writes of their first therapeutic intubation as follows:

Clinical application of the tube seemed very obvious, and I felt that it might be used for intestinal obstruction in order to extend the indications of duodenal drainage so that drainage might be obtained at a lower level. There was some doubt in all of our minds whether it would be possible for the tube to be propelled in cases of intestinal obstruction on account of the obvious reversal of flow in the intestinal tract. It was some time before we found a case in which we felt the use of the tube could be justified. This case came along in the person of an elderly man who had been on our service twice with an ileocecal intussusception and had steadfastly refused operation. Strangely enough, each time the man looked as though he might die from his obstruction, the obstruction released itself temporarily. During a third of these periods when the man was terrifically distended, Doctor Abbott and I passed the double-lumen tube into the small bowel and fortunately were able within about six hours to affect practically complete decompression. Since that time we have been using it quite regularly both for decompression in organic obstruction and ileus and for localization.[14]

Since then others as well as Johnston have used intubation for treating intestinal obstruction and have found it extremely valuable in most cases. As Johnston says the contraindications to its use can be summed up in one word, namely, strangulation. When strangulation is present the symptoms are likely to be so intense that its presence can be surmised and immediate operation performed.

The indication for using intubation in intestinal obstruction are all cases without strangulation and with any degree of distention. As with all therapeutic procedures it will be more helpful in some than in others. Where the distention is limited to the large intestine it will not likely be of much help, for though the tube sometimes traverses the ileocecal valve it can not be depended upon to do so with sufficient regularity to be routinely useful.

When the distention of intestinal obstruction is in the small intestine successful passage of the tube into the duodenum with proper suction applied will almost certainly result in relief of the distention within a few hours for unless the intestinal wall is necrotic the tip of the tube will be carried by peristalsis to the point of obstruction.

Relief of distention will often be a life saving procedure in itself for if the pressure within the lumen of the intestine becomes greater than that of the blood within the arterioles and capillaries supplying the wall of the intestine, necrosis leading to peritonitis results. Simple obstruction alone initiates a vicious circle of increasing distention for it has been fairly well shown experimentally that obstruction causes an outpouring of fluids into the intestinal lumen. This leads to increased pressure which if unrelieved leads to necrosis. It is imperative therefore that the distention be relieved as early as possible and intestinal intubation with suction is at present our most satisfactory method of relieving it.

Once distention has been relieved and no strangulation is present, the advantages of intubation are obvious. A definite number of patients will be cured and no further treatment needed. This particularly applies to those cases of so-called paralytic and reflex ileus and the ones due to kink. Any operative procedure will be facilitated and the danger of operation lessened for every surgeon of experience has learned to his regret that distention tremendously increases operative risk. By postponing the urgency of operation, opportunity will be afforded for the parenteral administration of fluids, minerals, blood and even food to overcome dehydration, hypoproteinemia, hypochloremia, and starvation. Roentgenologic examination with the tube in place will aid in localizing the site of obstruction and if desired a thin mixture of barium can be injected into the tube which will aid in study of the lesion. In addition the tube may be left in place during the operation and aid in finding the point of obstruction. Postoperatively it can be of great help in preventing distention and permit earlier administration of fluids by mouth.

In passing and operating the tube certain technical points must be carefully observed. The well-lubricated tube with the balloon deflated is passed to the stomach through the nose or mouth. After the tube reaches the stomach, passage is temporarily discontinued and the patient turned upon his right side. In the non-obstructed intestine the tube travels at the approximate rate of two feet each hour while in the obstructed intestine it travels approximately one foot per hour. After the patient is turned upon the right side, the tube is pushed downward three inches every fifteen minutes. At the end of ninety minutes the tip of it should be in the duodenum. At this stage it is often helpful to verify its position by means of a bedside x-ray plate or by fluoroscopy. Should x-ray facilities not be immediately available, one may attempt to determine its position by the following test. Introduce 20 c.c. of air into the balloon. If a sense of resistance is felt, one may be fairly sure that the balloon has passed the pylorus.

Suction should not be applied until the tip has entered the duodenum as the pylorus is more likely to be open when the stomach is full than when empty. After the tube is in the duodenum, 15 to 20 c.c. of air are introduced into the balloon and the tube leading to the balloon securely clamped. Passage of the tube at the above rate is continued. At the end of another ninety minutes the tip should be well within the jejunum and 20 to 25 c.c. of additional air are added and the air-tube again securely clamped. The balloon should not contain more than 60 c.c. of air. Somewhere between 40 and 60 c.c.

is usually the correct amount. More than 15 c.c. of air in the balloon while it is in the duodenum will likely lead to its expulsion back into the stomach.

Once the tube is in the duodenum, suction as described and popularized by Wangensteen is applied. The suction tip advancing ahead of the balloon decompresses the dilated intestine permitting it to grasp the balloon and propel it downward by peristaltic action. At times it will be advisable to flush the tube with warm water which tends to straighten kinks, dislodge any clogged material, and further liquefy the intestinal contents. Attendants must be cautioned not to confuse the tube leading to the balloon with the one leading to the suction tip. To do so may lead to an injurious degree of pressure within the balloon. Ordinarily five to six hours are required for the tip to reach the ileo-cecal valve. Suction can be maintained as long as needed and once decompression has been accomplished feeding by mouth can often be resumed.

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A CRITICAL REVIEW OF 1600 BLOOD TRANSFUSIONS IN PRIVATE PRACTICE

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THE therapeutic uses of blood transfusion have been so broadened within recent years that is now constitutes one of the major defensive and restorative measures known to medical science. Its beneficial effect derives from (1) an increase in the fluid volume of the blood; (2) an increase in the oxygen content through the transplantation of erythrocytes; (3) the stimulation of erythropoiesis in the bone marrow; (4) a hemostatic influence upon the patient's blood through the formation of thrombocytes; and (5) an immunizing and bactericidal power, produced by an increase of antibodies and complement. These factors make blood transfusion advantageous in both acute and chronic hemorrhage, in secondary anemia incident to debilitating diseases, in purpuric conditions and blood dyscrasias, and in infections and toxemias from any cause. Likewise, because of its nutritional properties, transfusion is invaluable as a preoperative and postoperative measure, and as a stimulant in surgical shock is frequently indispensable.

Primarily, blood transfusion is a substitute therapy, for the replacement of blood loss. As DeBakey and Honold have pointed out, no other substance can relieve so adequately and so physiologically the manifestations produced by blood loss. The diminished intravascular fluid bulk is restored immediately, and, in contrast to physiologic saline and other fluids which may be introduced into the vascular system, the infused blood contains the constituents necessary to maintain normal osmotic pressure. Consequently, the fluid of transfused blood is not lost into the tissues by diffusion, and the restored bulk is maintained permanently.[1] There is, moreover, evidence that a considerable portion of erythrocytes survive in the blood of the recipient for a period of three weeks. Thus, in the presence of severe acute hemorrhage, such as may arise from a peptic ulcer or esophageal varices, the transfusion of a large quantity of blood may be a life-saving procedure.

The beneficial effect of transfusion in the simple anemias is influenced not only by the increase in the fluid bulk, but also by the stimulus to the tissues and organs, which is reflected in better nutrition and better function of all the organs, and an improvement in general well-being.

From the Surgical Service of the Sanders Clinic.

The advisability of transfusion in some of the primary anemias and dyscrasias is perhaps less clear than in secondary anemia. In pernicious anemia, liver therapy has almost entirely supplanted blood transfusion; the latter is no longer considered necessary unless the hemoglobin falls quite low. In such conditions as thrombocytopenic purpura and hemophilia, however, and in the acute hemolytic anemia which occasionally follows the use of sulfanilamide, or icterus of obstructive origin, transfusion may completely restore the depleted constituents of the blood. In icterus of true hemolytic origin, blood plasma probably is more suitable; if red cells are necessary, the blood should be given in numerous small doses and the effect of each dose on the icterus carefully estimated.[2] It is well, in such cases, to administer alkalis prior to transfusion in order to prevent lysis of the patient's blood and the precipitation of hematin in the kidneys. Experiment has revealed that there is less danger of uremia from the hemolysis of transfusion when the recipient is on an alkaline diet sufficient to have a urine pH of 8.5, although some nitrogen retention occurs. With a urine pH of 6.0, death may ensue within a few days.[3]

The response to transfusion in aplastic anemia and agranulocytosis of infectious origin, or in chronic leukemia, though not permanent, is sufficient to afford temporary improvement and to add to the comfort of the patient. In all these conditions, transfusions should be limited in amount and given at frequent intervals, as indicated by the blood picture.

The advantages of transfusion in acute and chronic infections probably arises from the improvement in the patient's general resistance and the stimulation of bactericidal powers of the patient's blood, as well as from the immunity factors received in the donor's blood. Unless given strictly for the purpose of immunization, one should first be sure that a definite anemia or leukopenia is present; otherwise, there is no justification for transfusion in infections.

Among the toxic conditions which may be favorably influenced by transfusion are chemical poisons, puerperal sepsis, burns, ileus, and acute hemorrhagic nephritis. One should be cautious, however, in employing transfusion in the presence of renal insufficiency. If the insufficiency is advanced, certainly transfusion should not be considered. On the other hand, if the damage to the kidneys is only slight and transfusion is definitely indicated, one may be justified in the administration of small amounts of blood, provided alkaline therapy is first carried out.

Myocardial degeneration and pulmonary edema, likewise, are conditions wherein transfusion should be undertaken only in case

of extreme necessity. If given at all, the blood should be introduced very slowly, as in renal insufficiency, in order to prevent engorgement of an already weakened organ.

In no case must transfusion be regarded lightly. The risk, when all precautions are observed, is small and the benefits inestimable; misuse of the procedure, however, may result in reactions of varying degree, or even in fatality. Reactions may be brought about by (1) hemolysis incident to an incompatibility of bloods, (2) an allergic sensitivity of the patient's blood, or (3) chemical or bacterial toxins. Psychic states occasionally give rise to toxic reactions or to nervous phenomena following transfusion. Rarely, a technical error may cause an air embolus to form in the recipient's vein, and a consequent violent reaction, or perhaps death. Rarely, also, a patient experiences a severe reaction following the transmission of some unsuspected disease, such as syphilis and malaria. Some time ago a patient came under our care who, a few years previously, had been given two transfusions elsewhere, her son being the donor. A few days after a hysterectomy in our clinic, she was seized with epileptiform convulsions. Upon examination of her spinal fluid, she was found to be syphilitic. Investigation revealed that the son was the only member of the family who had a positive Wassermann reaction or a history of syphilis; he admitted having had a chancre a short time before giving the earlier transfusions. Such accidents serve to emphasize the necessity for precautions in the selection of donors.

Incompatibility reactions may arise from imperfect typing, from the use of a universal donor, or the use of the same donor for repeated transfusions. Errors in typing may often be explained by the presence of subgroups in the patient's blood, probably from the development of minor agglutinins. Since reactions are more frequently encountered in severe infections and blood dyscrasias, it is believed that these conditions, particularly, are prone to produce agglutinins; thus, in order to preclude the risk of an incompatibility reaction, only a donor of the same blood group as the patient should be used, rather than that of a universal donor. As a precaution against an incompatibility reaction in any case, the serum and cells of the donor should always be cross-matched with the cells and serum of the recipient.

Repeated transfusions from the same donor are also known to produce reactions, especially if given after an interval of five days. Whether such reactions result from an allergic sensitivity of the patient's blood or from the formation of specific agglutinins is not clear.

Hemolytic shock following the transfusion of incompatible blood, according to Gesse, is a complex concept of manifestations on the part of the blood vessels and heart accompanied by a depression of the central nervous system. By animal experiment, it has been shown that depressor substances released from broken down erythrocytes act directly on the blood vessel wall, causing arterial spasm, dilatation of the capillary bed, stasis, and a sharp fall in blood pressure. The heart action is secondarily affected as a result of insufficient flow of blood to the heart during diastole. The manifestations are usually quickly compensated for and are succeeded by a secondary phase provoked by spasm of the renal arteries and hemolysis. Derangement of renal function ensues as a result of the toxic action of the products of broken down red cells. A similar situation may be precipitated by the use of old compatible blood.[4]

Allergic reactions are usually encountered following the use of a non-fasting donor. In such cases, the patient is believed to be sensitive to certain offending foods in the blood of the donor.

Reactions of bacterial or chemical origin may be induced by the use of impure or old sodium citrate, of unclean apparatus or of new rubber tubing. This fact was well brought out only recently in one of our local hospitals. Of eight patients who were given transfusions by various surgeons by the citrate method, seven had reactions. No explanation could be found other than that the citrate solution used might be deficient in some respect. Upon investigation, the company from which it was purchased reported that the hydrogen ion concentration of the citrate was unsatisfactory. When the brand was changed, no further reactions attributable to this source developed.

In an attempt to throw some light upon the incidence of transfusions in different diseases, the various factors concerned in reactions, and other questions related to transfusions, the authors have recently conducted a study of 1600 transfusions in 800 private patients. The review covers a period of approximately fifteen years, from January, 1926, to August, 1940, and includes transfusions given for both medical and surgical diseases, practically all the latter being those which come under the observation of the general surgeon. Only cases upon which records were complete were included in the analysis. One-third, or 532 of the transfusions, were given between January, 1926, and November, 1935, to 283 patients. This does not represent the total number given during that period; the vast majority of the early records were lacking in some detail, thus reducing the number of acceptable transfusions prior to November, 1935, to 532. Two-thirds of the entire 1600,

or 1068, have been given by one of us (J.E.W.) since November 1, 1935, to 527 patients. An analysis of this group from the standpoint of incidence of transfusions in both medical and surgical cases for each of the past five years is interesting in that it reveals a recognition of constantly broadening indications for usage of the measure, particularly in surgical diseases.

TABLE 1.

Incidence of Transfusions in Medical and Surgical Cases

Nov. 1, 1935 - Aug. 1, 1940

	Patients			Transfusions		
	Medical	Surgical	Total	Medical	Surgical	Total
Nov., 1935-Jan., 1937	32	76	108	33	139	172
1937	11	62	73	21	130	151
1938	26	91	117	58	181	239
1939	28	108	136	81	232	313
Jan.-Aug., 1940	12	81	93	22	171	193
Total	109	418	527	215	853	1068

Four hundred five of the transfusions given during the first ten years were administered by various indirect methods. With comparatively few exceptions, the indirect method with the Lahey apparatus was employed in the larger group of 1068 transfusions. Some of the closed methods have the theoretical advantage of sterility, yet they have two disadvantages: (1) the blood must pass through a long tube, and (2) the procedure is too time-consuming, as the blood cannot be pumped into the vein. Further, in the 1068 cases, no donor was accepted who was known to have taken food

TABLE 2.

Blood Types of 800 Patients

Type	Number Patients
I	26
II	339
III	76
IV	359

within twelve hours. During the past few years, when time has allowed, the donor has been required to fast for a period of twenty-four hours. If more than 500 c.c. of blood is necessary, a second donor is used. No donor is used twice for the same patient unless

the second transfusion is given within five days of the first; after that time, the patient develops a sensitivity to the donor's blood.

The Moss classification of the four blood types was followed throughout in the 800 patients. The number of each type is shown in table 2.

Of the 527 patients transfused since Nov. 1, 1935, only one was known to have changed type. This patient, a man who was under treatment for urethral strictures, extravasation of urine, cellulitis of the groin, and a syphilitic infection, changed from Type IV to Type II.

For the purpose of simplification, the affections for which the transfusions were given were divided into six groups. These are given below, together with the number of patients and transfusions in each group.

TABLE 3.

Classification of Affections of 800 Patients With Number of Transfusions in Each Group

Type of Affection	Number Patients	Per Cent	Number Transfusions	Per Cent
Acute blood loss	68	8.5	179	11.2
Chronic blood loss	178	22.2	320	20.0
Secondary anemia	257	32.1	440	27.5
Dyscrasia	71	8.9	205	12.8
Infection and toxemia	213	26.6	422	26.4
Surgical shock	13	1.6	33	2.1
Total	800		1600	

The affections wherein transfusions were given for acute blood loss included gastrointestinal hemorrhages, incomplete abortions, ectopic pregnancies, and accidental wounds. The chronic blood loss group was comprised chiefly of bleeding duodenal ulcers, hemorrhoids, fibroids, and menorrhagias. The majority of the secondary anemias were associated with malignancies and other debilitating diseases, such as obstructing duodenal ulcers and gallbladders containing stones. In many, however, the cause of the anemia was unknown. The dyscrasias consisted of jaundice of any origin, pernicious anemia, thrombocytopenic purpura, hemophilia, leukemia and agranulocytosis. Included in the infections and toxemias were such disorders as cholecystitis, appendicitis, salpingo-oophoritis, abscesses, septicemia from any cause, undulant fever, empyema, and puerperal sepsis. Transfusions were given to thirteen patients

during or immediately after operation for surgical shock, for which no cause could be assigned. One of the thirteen went into shock at both of two different operations, two years apart.

To discover whether any relationship might possibly be ascribed to the different blood groups and the various pathologic conditions, the following analysis was made:

TABLE 4.

Classification of Blood Types of 800 Patients According to Affection

Type of Affection	Number Patients	Blood Types I	II	III	IV
Acute blood loss	68	0	29 (42.7%)	8 (11.8%)	31 (45.5%)
Chronic blood loss	178	10 (5.6%)	74 (41.6%)	14 (7.8%)	80 (45.0%)
Secondary anemia	257	7 (2.7%)	111 (43.2%)	23 (9.0%)	116 (45.1%)
Dyscrasia	71	2 (2.8%)	35 (49.3%)	7 (9.9%)	27 (38.0%)
Infection and toxemia	213	7 (3.3%)	85 (40.0%)	24 (11.2%)	97 (45.5%)
Shock	13	0	5 (38.5%)	0	8 (61.5%)
Total	800	26	339	76	359

Since the cases of shock were so few, for the purpose of comparison, this group may be excluded. It will be seen by comparing the percentages of patients of each blood type in the different disease groups, that the relative percentage with acute blood loss and infection and toxemia was higher in those of Type III. Also, a larger number of patients with chronic blood loss were Type I than those with other affections. Most interesting, however, is the comparatively high percentage of patients with dyscrasias with Type II blood, and the small percentage with Type IV blood.

TABLE 5.

Incidence of Reactions from 1600 Transfusions in Medical and Surgical Patients

	Medical	Surgical	Total Patients
Jan., 1926-Nov., 1935	24 (34.8%)	45 (65.2%)	69
Nov., 1935-Aug., 1940	10 (41.7%)	14 (58.3%)	24
Total	34	59	93

Reactions.—The study of the reactions was carried out (1) to determine the proportion of reactions in medical as compared to

surgical patients; (2) to discover the relative incidence and degree of reactions in patients of the four blood types in both medical and surgical cases, and (3) the incidence of reactions in the five disease groups. This review was made separately of the 532 transfusions given prior to November 1, 1935, and of the 1068 which were given after that date. In the latter series, no reactions were included which developed later than twenty-four hours after transfusion. The results of this study are shown in tables 5 and 6.

In table 5 two facts are brought out: (1) Reactions have been fewer within recent years, and (2) whereas in the earlier series the reactions predominated in surgical cases, within the past five years they have been higher in medical cases.

TABLE 6.

Classification of Patients Who Had Reactions According to Blood Types

	Blood Types				Total
	I	II	III	IV	Patients
Jan., 1926–Nov., 1935	1 (1.4%)	27 (39.0%)	8 (11.6%)	33 (48.0%)	69
Nov., 1935–Aug., 1940	0	14 (58.3%)	1 (4.2%)	9 (37.5%)	24
Total	1	41	9	42	93

The significant observation from the above table is that the proportion of patients of Type II and IV who had reactions was reversed during the past five years: the majority of patients in the first group were Type IV, whereas the majority in the second group were Type II.

During the entire period from January, 1926, to August, 1940, a total of 93 patients had 115 reactions. In the first series, 69 patients had 91 reactions. None of the 24 patients in the second series had more than one reaction. The degree of the reactions in both medical and surgical cases in the two groups is shown in tables 7 and 8.

In both these groups, the proportion of reactions was slightly higher in patients of Type II. This difference is more striking when one considers that, of the entire group of 800 patients, 339 were Type II, and 359 Type IV, as shown in table 4. No doubt, the presence of subgroups not discernible by the usual methods of matching and cross-matching was instrumental in the preponderance of reactions in patients of Type II. It would appear, also, that there is some connection between the higher proportion of patients with dyscrasias who were Type II and the increased num-

TABLE 7.

Classification of Reactions from 532 Transfusions According to Degrees of Reactions and Blood Groups of Patients

Reactions	Blood Types				
Medical	I	II	III	IV	Total
1st degree	0	6	2	6	14
2nd degree	0	7	1	7	15
3rd degree	0	3	0	4	7
4th degree	0	1	1	1	3
Total	0	17	4	18	39
Reactions Surgical					
1st degree	1	7	1	7	16
2nd degree	0	8	1	11	20
3rd degree	0	4	2	5	11
4th degree	0	2	0	3	5
Total	1	21	4	26	52

TABLE 8.

Classification of Reactions from 10.8 Transfusions According to Degrees of Reactions and Blood Groups of Patients

Reactions	Blood Types				
Medical	I	II	III	IV	Total
1st degree	0	4	0	1	5
2nd degree	0	3	0	1	4
3rd degree	0	1	0	0	1
4th degree	0	0	0	0	0
Total	0	8	0	2	10
Reactions Surgical					
1st degree	0	0	0	3	3
2nd degree	0	5	1	4	10
3rd degree	0	1	0	0	1
4th degree	0	0	0	0	0
Total	0	6	1	7	14

ber of reactions in this blood group. Several patients who had chronic leukemia received a number of transfusions. One patient alone of the first series had 16 transfusions for chronic leukemia, from which he suffered 8 reactions, including one anaphylactic shock. This patient was Type II.

One patient of the early series died following a transfusion given several days after an operation for intestinal obstruction and fistula, which in turn had followed removal of a ruptured appendix. At the time of the appendectomy, peritonitis had developed, the gallbladder was found to be moderately diseased, and the pancreas exceedingly firm. The patient was unconscious and in extremis at the beginning of the transfusion, and twenty minutes after its conclusion she had a mild rigor, her pulse became fast and weak, her respirations rapid, and death ensued within a short time. Postmortem examination of the abdomen failed to reveal any adverse effect of the transfused blood, or any definite reason for the sudden fatal outcome. This patient, also, and the donor as well, were Type II.

TABLE 9.

Classification of Reactions from 1600 Transfusions According to Degrees of Reactions and Affections of Patients

Jan., 1926-Nov., 1935 (532 Transfusions)	Acute Blood Loss	Chronic Blood Loss	Secondary Anemia	Dyscrasia	Infection and Toxemia	Total
1st degree	3	2	4	8	12	29
2nd degree	4	4	12	7	9	36
3rd degree	0	4	7	2	4	17
4th degree	2	0	4	2	1	9
Total	9	10	27	19	26	91
Nov., 1935-Aug., 1940 (1068 Transfusions)						
1st degree	0	3	5	1	0	9
2nd degree	1	3	2	1	6	13
3rd degree	0	0	0	0	2	2
4th degree	0	0	0	0	0	0
Total	1	6	7	2	8	24

A possible explanation is known for only two of the grade 4 reactions. One patient, whose blood was Type II, was given a transfusion by a Type IV donor following a satisfactory cross-agglutination. The transfusion was given for gastrointestinal hemorrhage, although the patient also had cirrhosis of the liver and an enlarged spleen. The blood of the universal donor may have been incompatible despite the successful cross-matching. The patient mentioned previously, who had an anaphylactic shock following one of

16 transfusions for chronic leukemia, on this particular occasion was given the blood of a donor who had been used six months before. It is worthy of note, in this connection, that another patient had a mild reaction following transfusion from a donor from whom she had received blood one year earlier. Thus, it would appear that a sensitivity to a donor's blood may persist indefinitely.

The foregoing table can best be understood by comparing the number of patients and transfusions in each disease group with the number of reactions in each.

TABLE 10.

Classification of 1600 Transfusions According to Affections and Respective Number of Patients and Reactions

Affection	Patients	Transfusions	Reactions
Jan., 1926-Nov., 1935			
Acute blood loss	22	45	9
Chronic blood loss	37	65	10
Secondary anemia	107	172	27
Dyscrasia	34	90	19
Infection and toxemia	81	154	26
Shock	2	6	0
Total	283	532	91
Nov., 1935-Aug., 1940			
Acute blood loss	46	134	1
Chronic blood loss	141	255	6
Secondary anemia	150	268	7
Dyscrasia	37	116	2
Infection and toxemia	132	268	8
Shock	11	27	0
Total	517	1068	24
Totals	800	1600	115

According to the number of both patients and transfusions of the early group, the reactions were highest in number in the acute blood loss and dyscrasia cases, while those in the chronic blood loss and infection and toxemia cases ranked second. The reactions were lowest in number in the secondary anemias.

In the second series, the patients with acute blood loss had the fewest reactions in proportion to the number of transfusions, and those with infection and toxemia a slightly higher ratio than the patients in the remaining disease groups. It will be observed also, that, in relation to the number of patients, the transfusions were

more numerous for acute blood loss; this, however, is not especially significant, in view of the nature of these cases.

The principal feature of this study is the relative proportion of reactions to patients and transfusions in the two series, i.e., before November, 1935, and after that date. These may readily be seen from the following table:

TABLE 11.

Percentage of Reactions from 1600 *Transfusions in* 800 *Patients*

Jan., 1926-Nov., 1935	Reactions (91):	Patients (283)—32% Transfusions (532)—17%
Nov., 1935-Aug., 1940	Reactions (24):	Patients (517)—4.6% Transfusions (1068)—2.2%

It is believed that the materially smaller percentages of reactions within recent years may be accredited to improved apparatus and consequently more thorough asepsis, as well as to better technical methods and a more complete understanding of the biochemical factors upon which the success of transfusion so largely depends. No doubt, a still more comprehensive grasp of the entire problem will be reflected in an ever wider usage of this valuable therapeutic aid, with an even smaller risk than is now involved.

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STENOSING TENDOVAGINITIS AT THE RADIAL STYLOID PROCESS

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THE clinical and pathologic entity known as stenosing tendovaginitis, or DeQuervain's disease, has been adequately described and not infrequently discussed in the literature. However, it is barely mentioned, or completely overlooked, in most texts, and little or no attention is paid it by most physicians and surgeons. While it is a relatively minor condition, it causes severe pain, which is steadily progressive in severity, and frequently is disabling. It is easily cured surgically, and the results obtained by operation are routinely successful and highly gratifying. For these reasons it seems worth while again to present this condition for consideration.

In 1895, DeQuervain first described the process of thickening of the sheath, with narrowing of the lumen, for the tendons of the abductor pollicis longus and extensor pollicis brevis as they pass in their groove on the lateral aspect of the styloid process of the radius. While the same pathologic process can and does develop in other regions, as emphasized by Keyes, it is this localized lesion which occurs most frequently and produces a definite clinical picture with characteristic symptoms and signs.

The exact incidence of the condition cannot be determined, as only about two hundred fifty cases had been recorded up to 1938. Finklestein reports a series of 32 cases in one clinic in less than four years, and other series of as many as 28 cases are on record. This would lead one to believe that the disease is rather more frequent than the total number of cases reported would indicate, and either that it is not diagnosed as often as it should be, or that many cases are not reported. The condition is seen much more frequently in women than in men, and usually occurs between the ages of 25 and 45.

According to most authorities, the etiologic factor in this condition is usually chronic trauma, in the form of friction and repeated motions, or stretching of the involved tendons, producing pressure on their sheath. Finklestein states that the most frequent cause is over-exertion in household duties, or it may result from other occupational causes, such as sewing, typing, cutting, and various procedures involving strains on the thumb and wrist. In some instances, acute trauma, in the form either of a direct blow or a fall on the wrist, is given as the cause of the condition, and very rarely, it is said to follow fractures. In some cases, no apparent cause is

ascertained for the disease, but apparently it is never tuberculous, syphilitic or arthritic.

For complete accurate discussions of the anatomy, physiology, and pathology of this lesion, the reader is referred to the works of Finklestein, Patterson, and Keyes, in the recent literature. It is the general belief that the friction of repeated motions, and the pressure of the tendons upon their sheath when they are stretched, produce changes leading to destruction of the serous lining of the sheath, hypertrophy and fibrosis of its connective tissue portion, and ultimately, hyaline or even calcareous degeneration. The tendons themselves usually are not involved, although in some instances they are adherent to the sheath or show bulbous swellings just above or below the constriction. This pathology, it will be noted, is similar to that often responsible for snapping thumb or trigger finger if the flexor tendon sheaths are involved.

In addition to the history of trauma, which is usually given by the patient, the outstanding symptoms of the condition are:

1. Pain over the lateral border of the wrist, aggravated by activity, steadily progressive in character, sometimes extending upward toward the elbow or distally into the thumb.

2. Stiffness of the thumb, causing some limitation of motion.

3. Weakness of the hand and wrist, so that patients say they cannot carry objects in the hand, but drop them because of weakness and pain. Turning doorknobs often is impossible.

On examination, there is found to be localized tenderness over the lateral border of the radial styloid, and often a hard, oval tumor is palpable. There is usually some limitation of abduction and extension of the thumb, and the prominence of the tendons of the long abductor and short extensor of the thumb is absent or diminished in the lateral border of the "snuff-box" during active extension. In addition to these findings, there is one characteristic manifestation exhibited by these patients which is practically pathognomonic. If the thumb is flexed and adducted into the palm and the fingers closed tightly over it, excruciating pain is produced when the wrist is forced into ulnar deviation. If the thumb is not fixed in the palm, motions of the wrist are not painful.

The ordinary laboratory examinations are entirely normal in this condition, and x-rays usually reveal no evidence of disease, although they should be taken in every case.

So far as the differential diagnosis is concerned, it must be stated that this condition has been erroneously diagnosed as hypertrophic arthritis, sprain of the wrist, ganglion, and other widely varying

conditions, apparently because the condition of stenosing tendovaginitis had not been considered, or its existence not known. The disease should be readily diagnosed, if one is on the look-out for it from the fairly typical and constant points of the history and physical examination as outlined above, negative x-ray examinations and normal laboratory data. In every instance, however, other lesions must be excluded, by means of careful complete examination, routine x-ray studies and laboratory procedures if indicated. Among the numerous conditions to be considered in the differential diagnosis, the following should be mentioned: Fractures, aseptic necrosis, or cysts of the carpal navicular; sprain of the external lateral ligament of the wrist; fracture of the styloid process of the radius; tuberculous tenosynovitis, osteitis or arthritis; tendovaginitis crepitans; periostitis, neuritis and arthritis from any cause.

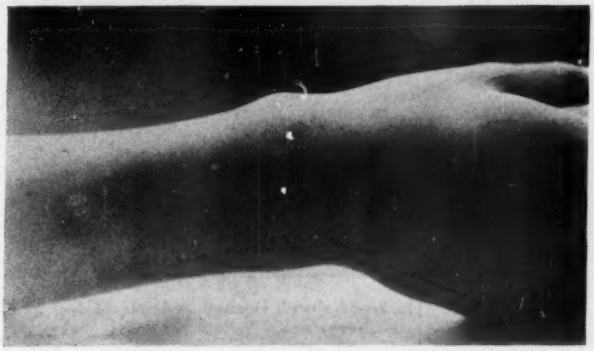

Fig. 1. Location of typical swelling in DeQuervain's disease.

While stenosing tendovaginitis may simulate any of these lesions, each may be diagnosed by typical clinical x-ray or laboratory findings not present in DeQuervain's disease, and none of them is characterized by the localized tenderness and swelling present in this condition, nor by the pathognomonic sign of severe pain produced when, with the thumb flexed and adducted in the palm, the wrist is forced into ulnar deviation.

The treatment of choice, in practically all cases, is surgical excision of the thickened portion of the sheath, thereby relieving the pressure on the tendons and permitting free complete motion of the part. This is a very easy procedure, can be done under local anesthesia, and causes no untoward complications. Pain disappears rapidly, convalescence is short, and the results are uniformly successful. The thickened portion of the sheath should be excised rather than merely incised longitudinally, as the tenderness other-

wise may persist. Conservative measures, in the form of immobilization of the wrist and thumb, the latter in complete abduction and extension in a plaster of Paris cast, or the application of heat and counter-irritants, may be tried early in the disease, but usually are of little value. If relief has not been obtained within three or four weeks, certainly surgery is to be advised.

As has been stated, the results following surgery are uniformly good. No postoperative fixation is necessary, and active motion may be started as soon as the pain from the operation has subsided and healing has started satisfactorily, usually only a matter of several days. By the end of two or three weeks at the most, full range

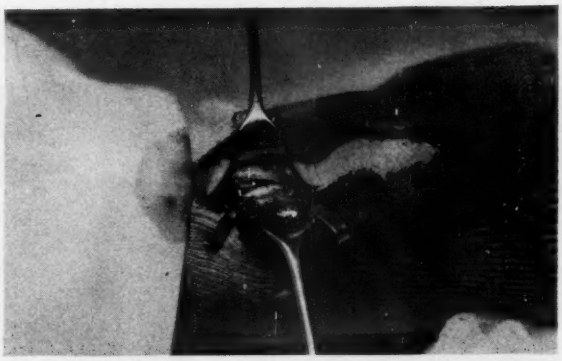

Fig. 2. Thickened sheath exposed and incised.

of painless motion has returned and any type of work is possible. So far as is known, there have been no recurrences and only two cases are reported where complete relief of all symptoms was not obtained. In both of these cases, localized tenderness persisted following simple incision of the sheath, which was so thickened that it was almost cartilaginous in consistency.

To illustrate more graphically the outstanding features of this condition, the following case report is of value:

A white housewife, aged 32, complained of a painful swelling of the right wrist. She stated that she had first noticed pain in the region of the right wrist about seven months previously. At first, the pain had been present only when she was actively using the hand, but it steadily became worse, and soon was constant, causing some stiffness and weakness of the thumb. About a month after the onset of her pain, she had noticed the appearance of a rounded swelling on the side of the wrist which was quite tender, and gradually grew larger. At that time, x-rays were taken of the wrist which were said to show no evidence of bone or joint disease. She was treated by heat and strapping without improvement, the pain becoming steadily worse, and the stiffness more dis-

abling. She also stated that the wrist was weak, and that she frequently dropped objects she was carrying. She gave no history of disease, and had no constitutional symptoms suggestive of infection.

Significant physical findings were limited to the distal part of the right upper extremity. On the lateral border of the wrist, directly over the styloid process, was a rounded, circumscribed swelling, about 1 cm. in diameter (fig. 1). It showed no signs of inflammation, but was acutely tender to pressure. Active extension of the thumb was limited, and tendons of the short extensor and long abductor failed to form the usual prominence of the lateral border of the "snuff-box" during extension of the thumb. Passive flexion of the thumb was slightly painful. With the thumb flexed and adducted beneath the fingers, forcing the hand and wrist into ulnar deviation caused excruciating pain. Motions of the wrist were not painful, and there was no involvement of the

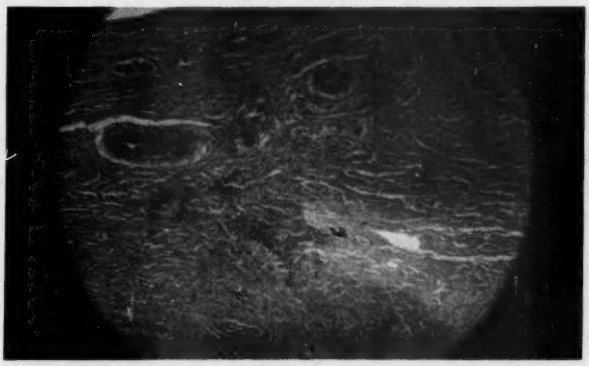

Fig. 3. Low power photomicrograph showing hyalinized scar tissue and thick walled blood vessels.

joints of the fingers or thumb. There was no evidence of peripheral nerve lesion.

Anteroposterior and lateral x-rays of the wrist and hand showed very slight roughening of the surface of the styloid process of the radius interpreted as periostitis.

Under local anesthesia, the swelling was exposed through a one-inch longitudinal incision. It was shiny, pearly gray and hard; it involved the complete circumference of the sheath for a distance of 1 cm. The thickened portion was incised longitudinally. On cutting, the tissue transmitted a gritty sensation and bled sparsely from its cut surface. On opening the sheath, a few drops of straw colored fluid exuded, and a small amount of granulation tissue was seen joining the tendons to the sheath. The tendons themselves (fig. 2) appeared otherwise normal, and moved freely as soon as the construction was completely released. The entire mass of thickened sheath was excised, after which the fascia and skin were approximated loosely over the tendons.

The incision healed per primum, pain was entirely absent four days after operation, and the patient had full range of motion at the end of ten days. She has remained entirely free of all symptoms and has no disability.

The pathologist's report as given by Dr. H. M. Weeter, was as follows:

"Sections show much dense hyalinized scar tissue and endarterial obliteration of many of the vessels—one surface of the fragment appears to be lined in part at least by elongated flattened cells."

Conclusions

1. Stenosing tendovaginitis at the radial styloid should be more frequently considered as one of the causes of painful disability of the thumb and wrist.

2. It can be readily diagnosed by fairly typical symptoms and signs, and exclusion of other lesions by normal x-ray and laboratory findings.

3. It can be cured by a simple surgical procedure, giving excellent results.

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THE RELATIONSHIP BETWEEN FECALITHS IN THE APPENDIX AND GANGRENOUS APPENDICITIS

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IN THE last few years there have appeared in the medical literature papers about appendicitis which have revealed a vague consciousness among surgeons that something is amiss in the treatment and control of this disease.

Examination of the statistics of deaths from appendicitis in the last twenty-five years shows cyclic fluctuations in the mortality rates[1,2], which have varied from 11 to 16 per 100,000. The highest rates occurred in the period from 1925 to 1930, inclusive; in the last several years the rates have decreased. In view of these facts, caution should be exercised in accepting the conclusion that merely because the number of reported deaths from appendicitis in 1930 was greater than the number in 1911, there is a definite upward trend in the mortality rate from appendicitis.

The Metropolitan Life Insurance Company, in 1927, published a report on the results of appendicitis which was based on twenty-five years of experience with industrial policyholders. It depicted an average annual mortality rate in the five year period from 1911 to 1915, inclusive, of 12.9 per 100,000; in the five year period from 1931 to 1935, inclusive, it was 15.5 per 100,000. The average mortality rate for the twenty-five year period was 14.8 per 100,000. Appendicitis was in tenth place among the causes of death; 1.4 per cent of all deaths were due to this disease.

Bower[3], in 1931, reported a series of 5,121 cases of appendicitis observed in Philadelphia hospitals, in which there were 306 deaths, a mortality rate of 5.97 per cent. Difference in incidence of appendicitis in males and females was noted only in the age period from 20 years to 45, in which the disease occurred oftener in men, and had a higher mortality rate, than in women. The mortality rate did not vary widely according to age, except that it was definitely higher among elderly patients.

Stanton[4], in 1934, published a review of ten articles on appendicitis in which there had been reported 16,424 cases, with 894 deaths, an average mortality rate of 5.5 per cent. The lowest mortality rate in the group was 3.5 per cent and the highest 6.5 per

cent. A review of 4,343 cases of appendicitis compiled from ten articles which had been written twenty years earlier revealed a mortality rate of 6.2 per cent.

From the evidence quoted and from numerous other data it is apparent that the average fatality rate of acute appendicitis is from 5 to 6 per cent, that this rate is not affected by sex or age of patients, except as previously noted, and that in twenty-five years it has varied little, either upward or downward. Considering all of this evidence together with the increase in population, apparently the annual incidence of appendicitis today is approximately what it was twenty-five years ago. Although there is no way to compare the severity of the disease today with its severity in that earlier period, presumably it is no greater now than formerly. That advance in surgical knowledge and improved facilities for operating have not resulted in a material reduction of the mortality is of interest.

Authors' Investigation

In the course of observations it occurred to us that while the increased use of purgatives early in appendicitis and radical surgery late in the disease may have worked against improvement in the mortality rate, there might be other less obvious or hidden reasons for the lack of improvement. Tentatively it was suggested that perhaps one type of appendicitis which was not being treated adequately was accounting for most of the deaths. Selecting for our series only cases in which appendicitis was the primary consideration, we studied 1,954 cases of appendicitis in which operation was performed at the Mayo Clinic in the five years from 1935 to 1939, inclusive. In 1,103 of these cases chronic appendicitis was diagnosed; in 284 cases, subacute appendicitis. Because lymphoid tissue is present normally in the appendix, a subsiding acute reaction with a few polymorphonuclear leukocytes present in the blood cannot be distinguished practically, from the pathologic viewpoint, from an early acute reaction which is becoming more severe. In 370 cases acute purulent appendicitis was diagnosed unquestionably. One hundred ninety-seven patients had gangrenous or ruptured appendixes, some with local abscess and some with general peritonitis.

Fourteen hospital deaths occurred in this series of cases. Of the patients who died, three had chronic appendicitis, three had subacute appendicitis, one had acute purulent appendicitis, and seven had gangrenous or perforative appendicitis.

These data, and especially the fact that half the deaths were of the patients with gangrenous or perforated appendixes, in the group

which constituted only one-tenth of the cases of the series, partially confirm our hypothesis that a small group of cases contributes largely to the mortality rate of appendicitis.

That gangrenous appendicitis has always been accompanied by a high mortality rate is well known. Reid[5], and his associates in 1936, reported a series of 2,921 cases. In the cases of unruptured appendicitis the mortality rate was 0.86 per cent; in the cases of rupture with local abscess the mortality rate was 11.4 per cent, and in cases of perforation with general peritonitis, 33 per cent. Gray and McKenzie[6], in 1937, published a report of 674 cases. In those in which the appendix was unruptured the mortality rate was 0.6 per cent; in the cases of perforation with local abscess the mortality rate was 10 per cent, and in the cases of perforation with general peritonitis, 21 per cent. The important feature of the series which we report here is that in only a small fraction, one-tenth, of the cases was appendicitis due to gangrene or perforation.

TABLE 1.

Fecaliths and Appendicitis, 1935-1939 *Inclusive*

Type of Appendicitis	Number	Fecalith		Nonfecalith		Per cent of cases with fecalith in type indicated
		Cases	Per Cent	Cases	Per Cent	
Acute purulent	370	55	18.9	315	18.9	14.9
Acute gangrenous	197	48	16.5	149	9.0	24.4
Subacute	284	33	11.3	251	15.1	11.6
Chronic	1103	155	53.3	948	57.0	14.1
Total	1954	291	100	1663	100	14.9

Inasmuch as gangrenous appendicitis was largely responsible for the deaths, we were interested in determining the differences between the cases of this form of the disease and the cases of other types of appendicitis. In each of the 1,954 cases of appendicitis in this series, study was made of the reports of surgical and pathologic findings to determine whether or not fecalith had been present. The cases were divided according to the type of appendicitis: acute purulent, acute gangrenous, subacute and chronic.

Table 1 gives a summary of the numerical incidence of the different types of the disease. The incidence of fecaliths in the purulent, subacute and chronic types was of the same order (14.9, 11.6, 14.1), but the relative incidence in the acute gangrenous cases was almost twice as high (24.4). It is more enlightening to look at the relative incidence from another point of view, that is, to note the proportions of the different types of appendicitis present, accord-

ing to whether or not the appendix contained a fecalith. These percentages are also given in table 1. The outstanding difference in the relative incidence again concerns acute gangrenous appendicitis, for of the appendixes which did not contain fecaliths, 9.0 per cent were gangrenous, whereas, of the appendixes with fecalith, 16.5 per cent were gangrenous.

A plausible and reasonable explanation of these findings would be that the presence of a fecalith in an appendix almost doubles the probability that a gangrenous condition will occur. On the basis of these data we may judge that owing to the presence of fecalith, subacute appendicitis in a small number of cases, and chronic appendicitis in a similar number progress to a state of gangrene, thereby decreasing the relative incidence of subacute appendicitis and chronic appendicitis in the group with fecalith and increasing the relative incidence of gangrenous appendicitis in this group.

From this evidence we may judge that fecalith in some cases is the cause of gangrenous appendicitis and that, apparently, in no case is it responsible for acute purulent appendicitis. This basis for assumption is especially significant since it is the cases of gangrenous appendicitis in which the mortality rate is high.

Undoubtedly, however, other factors besides fecalith contribute to the occurrence of gangrenous appendicitis. In only 24 per cent of the cases of gangrenous appendicitis was fecalith present in the appendix; all of the fecaliths were counted; many obviously were not producing obstruction and therefore could not be considered as causing gangrene. Assuming that constricting bands and anomalies were the cause of gangrenous appendicitis in another 25 per cent of the cases in this series, there remain half the cases in which the gangrenous condition must be explained by some other means.

Summary and Comment

On the basis of the evidence it appears that fecalith is not a factor in the production of acute purulent appendicitis. The relative incidence of the purulent type of the disease is the same, 18.9 per cent (table 1), in cases with fecalith as in cases without fecalith.

That fecalith is associated with gangrenous appendicitis is evident, for gangrene occurs in 16.5 per cent of cases with fecalith, and in only 9.0 per cent of cases without fecalith, a difference which has statistical significance. Whether infection in a chronically or subacutely inflamed appendix is aggravated by fecalith to progress to gangrene, or whether the fecalith is the primary cause of infection, is debatable. Both processes probably occur. At any rate it appears that in the series of cases with fecalith, gangrene occurred

in the course of subacute appendicitis and chronic appendicitis rather than in acute purulent appendicitis. Therefore, it seems logical to suppose that gangrenous appendicitis with obstructing fecalith has not developed from the subacute or chronic stage, through the acute purulent stage, but probably has proceeded directly to gangrene from its quiescent or early stage.

Until the cause of acute purulent appendicitis is known, it probably will be impossible to determine whether fecalith plays a primary or a secondary role in the causation of gangrenous appendicitis.

A clinical diagnostic method which routinely would determine the presence of fecalith would enable the surgeon to make timely removal of the appendix in cases in which gangrene would be likely to occur in the future with consequent high mortality. Only by early intervention in cases of suspected gangrene shall we be able to reduce the mortality in this comparatively small group of cases which is largely responsible for the present level of the mortality rate for appendicitis as a whole.

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PULMONARY COMPLICATIONS IN SURGERY OF THE BILIARY TRACT

A Study of 132 Consecutive Cases

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PATHOLOGIC changes in the respiratory tract have always been among the most frequent and most fatal complications of operations in the upper abdomen. Various theories have been advanced to explain the relatively high incidence of these conditions, and various preoperative and postoperative measures have been suggested to aid in their prevention, but we apparently have not yet struck upon the real answer. Bronchopneumonia, atelectasis, and other pulmonary affections continue, therefore, to cause prolonged convalescence, if not death, following this type of surgery.

The gallbladder and its associated ducts are more frequently subjected to surgery than any other organ in the upper abdomen. Various authors have reported respiratory complications following gallbladder surgery ranging in incidence up to 36 per cent. Only gastric surgery is followed by a higher percentage of pulmonary complications.

In this series of cases, cholecystectomy was done in 89 instances, cholecystostomy in 20, exploration of the common duct in 6, and combined cholecystectomy and choledochostomy in 10 cases. Various other operative procedures account for the remaining seven cases of the series (chart 1).

In 45 of these cases the appendix was removed, and in 18 cases some other surgical procedure was also done at the time of the biliary tract operation.

As would be expected, the female patients outnumbered the males in the total series by 105 to 27, a proportion of almost 4 to 1. The average age of the female patients was 45.4 years, and for the males 54. 3 years (chart 2).

In the total series of 132 cases, there occurred 7 deaths, a mortality of 5.3 per cent.

Gas-oxygen-ether anesthesia was used in 109 cases, spinal anesthesia in 16, local infiltration in 1, combined local infiltration and gas in 2, and spinal supplemented by gas in 4. It should be mentioned that, though the operative record states merely that the

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From the service of Drs. Irvin Abell, M. J. Henry, and Irvin Abell, Jr., St. Joseph Infirmary, Louisville.

anesthetic agent was gas-oxygen-ether, cyclopropane was used in the vast majority of these cases and the record should more properly read "cyclopropane-oxygen-ether."

CHART 1. SURGERY OF THE BILIARY TRACT.

Operation	Cases	Appendix Removed	Additional Surgery
Cholecystectomy	89	40	10
Cholecystostomy	20	3	4
Choledochostomy	6	0	1
Cholecystectomy-choledochostomy	10	1	3
Choledochostomy-cholecystduodenostomy	2	0	0
Choledocholithostomy-cholecystostomy	1	1	0
Cholecystostomy-choledochostomy	2	0	0
Cholecystostomy-cholecystjejunostomy	1	0	0
Cholecystduodenostomy	1	0	0
Totals	132	45	18

Pulmonary complications occurred in 12 cases, an incidence of 9.1 per cent, and in 4 of these cases death ensued. The respiratory disease was the immediate cause of death in 3 cases, and was a contributory factor in the fourth.

Bronchopneumonia developed in five cases, three of which terminated fatally. Atelectasis was present in four patients, one of whom suffered a circulatory collapse and died after the lungs had shown considerable clearing. Bronchitis was diagnosed in two cases, and pulmonary edema in one instance. Each of these patients made an uneventful recovery (chart 3).

CHART 2. AGE-SEX DISTRIBUTION.

Age	Male	Female
20-29	1	16
30-39	2	23
40-49	6	22
50-59	8	24
60-69	8	18
70-79	2	2
Total	27	105
Average Age	54.3	45.4

In a careful study of the five cases of bronchopneumonia, it was noted that in two cases (nos. 1 and 5, chart 4) the patients had rather extensive involvement of the entire biliary tract and that dur-

ing the postoperative period each had an exacerbation of the infection with its consequent debilitating effect on the general physical condition. With resistance at a low ebb, the pulmonary complication arising late, proved fatal.

CHART 3. PULMONARY COMPLICATIONS.

	Cases	Deaths
Bronchopneumonia	5	3
Atelectasis	4	1
Bronchitis	2	0
Pulmonary Edema	1	0
Total	12	4

Case 2 was probably the result of a mistaken diagnosis. The abdomen revealed nothing to account for the acute symptoms and leukocytosis. The course, from the onset, was septic and x-ray on the fifth day revealed bilateral massive bronchopneumonia. It is reasonable to believe that the pneumonia was present in its early stages at the time of operation.

In case 3 the patient showed little clinical evidence of respiratory disease but the x-ray findings were consistent with those of bronchopneumonia. The recovery was uneventful and hospitalization prolonged but a few days.

The fourth case was subjected to unusual intra-abdominal trauma because of the dense adhesions in the upper abdomen resulting from the previous operation. This, together with a weak heart, made this patient a poor risk at best.

In an attempt to analyze the four cases of atelectasis, it is felt that the mild involvement of the left lung in case 6 (chart 4) may be attributed directly to the elevation of the diaphragm resulting from a paralytic ileus. In the other three cases, atelectasis is more difficult to explain. The one fatality in this group, in case 9, occurred while the atelectatic condition was clearing and was due to circulatory collapse.

Of the two patients with a diagnosis of bronchitis, one was given an inhalation anesthetic and the other a spinal, yet both developed severe productive coughs on the second postoperative day. It seems highly probable that the bronchial trouble was present previous to operation in a chronic, though possibly latent, form.

In the last case, the pulmonary complication was the direct result of a circulatory collapse on the second postoperative day, and

CHART 4. SUMMARY PULMONARY COMPLICATIONS.

Case No.	Age	Admitted	Operation	Anesthetic	Onset Pulm. Symptoms Day P. O.	Pulmonary Complication	Highest Temp.	X-Ray	Outcome
1.	55	July	cholecystectomy choledochostomy	G.O.E.	21st	bronchopneumonia	105	No	Death 22nd
2.	27	April	appendectomy cholecystostomy	G.O.E.	2nd	massive bilateral bronchopneumonia	104	Yes	Recovery
3.	50	Dec.	cholecystectomy	G.O.E.	7th	bilateral bronchopneumonia	100	Yes	Recovery
4.	35	Sept.	cholecystectomy	G.O.E.	5th	bronchopneumonia	107	Yes	Death 10th
5.	65	March	cholecystectomy choledochostomy	G.O.E.	28th	bronchopneumonia	103	No	Death 29th
6.	58	Sept.	cholecystectomy	G.O.E.	2nd	mild atelectasis	103	No	Recovery
7.	39	Oct.	cholecystectomy	G.O.E.	2nd	massive atelectasis right lung	102	Yes	Recovery
8.	60	May	cholecystectomy appendectomy	G.O.E.	2nd	atelectasis	102	Yes	Recovery
9.	49	Feb.	cholecystostomy appendectomy	G.O.E.	5th	massive atelectasis	105	Yes	Death 11th
10.	67	July	cholecystectomy choledochostomy repair common duct.	G.O.E.	2nd	bronchitis	101	No	Recovery
11.	43	Nov.	cholecystectomy appendectomy	Spinal	2nd	bronchitis	98.8	No	Recovery
12.	42	March	cholecystectomy	G.O.E.	2nd	pulmonary edema	103	No	Recovery

cleared up in a relatively short time with stimulants and oxygen therapy. The effects of this episode, however, probably played a part in the prolonged and stormy convalescence.

Numerous theories have been advanced to explain the occurrence of these postoperative pulmonary complications. The anesthetic agent has been blamed in many instances, and a few years ago a great deal of stress was placed upon the so-called "ether pneumonia." In recent years, however, investigators have shown that in large series of cases the anesthetic agent had little bearing on the incidence of pulmonary complications and, in fact, the percentage was usually a little higher with spinal anesthesia than when ether or other inhalation agent was used[1]. Local infiltration and rectal anesthesia (avertin), likewise, had little effect on the occurrence of these conditions.

In the series of cases under consideration, it will be noted that, in eleven of the twelve cases developing postoperative complications, the anesthetic agent was gas-oxygen-ether, an incidence of 10.1 per cent of the cases operated under inhalation anesthesia. Only 6.2 per cent of those done under spinal anesthesia developed respiratory trouble—and this one case was bronchitis, with no elevation of temperature at any time. This would seem, at first, to lend some weight to the theory of ether irritation, but it must be pointed out that spinal was used in only 16 cases, or 12.1 per cent of the total of 132 cases, certainly too small a number on which to base any conclusion.

Preoperative respiratory infection, indeed, must be carefully considered in candidates for major surgery, and the generally accepted policy of postponing all elective surgery for at least two weeks after an acute respiratory flare-up, must be acknowledged as good surgical judgment. It has been thought by those who believe that these pre-existing infections play a part in postoperative complications, that the complications showed a seasonal incidence, being higher during the winter months when common colds, middle ear infections, and sinusitis are more frequent. A careful examination of the hospital records of the twelve patients in this series, however, fails to reveal any evidence of recent respiratory trouble. It is interesting, also, to note that the twelve complications were distributed through nine months of the year, six being in the period from October 1 to March 31, and six in the warmer months from April 1 to September 30. It may be pointed out, too, that of the six complications occurring in the fall and winter months, only two may be classed as true infections.

Because of the importance of the abdominal muscles in respiration in the male, it has been felt that pulmonary complications are more likely to occur in males than in females when these muscles are splinted as a result of upper abdominal surgery. This observation is borne out in this series. Four out of 27 male patients, or 14.8 per cent, developed pulmonary complications. In the female group, eight patients, or only 7.62 per cent of the total of 105, had such difficulties following surgery.

Interference with respiration caused by pain in the operative wound, by the use of comparatively large doses of morphine, and by the use of tight abdominal binders or adhesive plaster dressings has been stressed from time to time in the literature dealing with the etiology of postoperative pulmonary complications[2]. It is rather difficult to utilize these factors in explaining the cases in this series. Granting that with an upper right rectus incision there will be a certain amount of splinting of the upper abdominal muscles due to pain, it was rarely necessary to administer morphine in dosages greater than one-sixth grain every three or four hours, and in no case was morphine given when the respiratory rate was below 16 per minute. Binders were used only in rare instances, and adhesive plaster was used not for support, but only to secure the gauze dressing in place.

Donald S. King[3] believes that excessive bronchial secretions, retained in the bronchi by one or a combination of the above mentioned factors, is the most plausible explanation of these pulmonary complications, but points out, at the same time, that these factors do not explain the excess of bronchial secretion.

General surgical shock, in varying degrees, impairment of the pulmonary circulation, similar to the changes in the peripheral circulation, or loss of body heat which occurs when the abdomen is opened—any one or all of these may contribute to the accumulation of the excess of bronchial secretion.

Hinshaw[4], of the Mayo Clinic, believes that defective pulmonary drainage is the primary cause of many cases of postoperative pneumonia. This defective drainage he attributes to one of two things: (1) the inspissated character of the secretions, or (2) to improper function of the normal clearing mechanisms of the tracheobronchial tree. When these secretions stagnate, bronchial obstruction is followed by atelectasis, which, if not promptly overcome, will result in pneumonia.

It is Yandell Henderson's opinion[5] that the retention of the secretions is due, possibly, to a loss of tonus of the respiratory muscles (and all other muscles of the body) following major surgical

procedures, resulting in a diminution of the size of the thoracic cavity. This, in turn, causes a partial deflation of the lungs and leaves many small areas of lung tissue deprived of air. Playing a part, also, is the resultant poor return of blood to the right heart.

Prophylaxis of postoperative pulmonary complications in surgery of the biliary tract must be considered as a part of the preoperative care, beginning, in some instances, long before the patient is hospitalized for surgery. The patient's general physical condition should be brought as near to the optimum as is possible. In elective surgery, as was mentioned above, at least two weeks should elapse following an acute upper respiratory infection before surgery is attempted. The mouth and teeth should be clean and free of infection. Depending upon the state of nutrition and the blood picture, intravenous infusions of glucose and saline, and blood transfusion should be given. It is my opinion that gallbladder patients should receive intravenous glucose for at least two to three days before operation whenever possible.

At operation the surgical procedure should be carried out as rapidly, yet as carefully and gently as possible. The anesthetic agent, as pointed out above, seems to have little bearing upon the postoperative pulmonary complications, but the anesthetist may. Whatever the agent, it should be administered as smoothly as possible, and the patient watched carefully throughout the operative and immediate postoperative periods.

Walters, Snell, and Butt[6] recommend the aspiration of mucus from the bronchi before the patient leaves the operating room as an aid in preventing postoperative pulmonary complications. They also believe that oxygen, administered either by means of the oxygen tent or by the "B.L.B." mask, is a valuable prophylactic agent in cases in which pulmonary complications may develop.

In the postoperative period, good nursing care is, in my opinion, the most important factor in the prevention of pulmonary complications. Frequent changes of position, occasional periods of postural drainage, careful guarding against the inhalation of vomitus while asleep or when awakening from the anesthetic, and frequent deep breathing exercises will do more than anything else to prevent these conditions.

The patient's environment should be kept at an even temperature, with particular attention to the avoidance of drafts. Attention must be paid to the maintenance of a proper balance between fluid intake and output. During the first few days glucose and saline must be administered parenterally.

The use of carbon dioxide inhalations at regular intervals to promote deep breathing are advised but seem to accomplish little more than can be attained with simple deep breathing exercises. The use of expectorants to loosen a thick, tenacious bronchial secretion may be of some value early, but is of doubtful efficiency after atelectasis or bronchopneumonia has developed.

Early bronchial drainage, by bronchoscopy if necessary, seems to be the best treatment for pulmonary collapse. Postoperative bronchopneumonia should be treated the same as any case of true bronchopneumonia. The advances made in recent years in the chemotherapeutics of this disease encourages one to hope that the mortality in upper abdominal surgery due to postoperative pneumonia may be still further reduced. Sulfanilamide, sulfapyridine, and now, sulfathiazole have proved of great help. Investigators[7] advise the use of the drug as soon as respiratory symptoms appear and that optimal concentration of the drug in the blood be maintained until the temperature has been normal for at least forty-eight hours. The most frequent error in chemotherapy is the discontinuance of the drug too early.

Conclusions

This series of cases is too small to draw any definite conclusions as to the etiology or prophylaxis of postoperative pulmonary complications.

It does lend weight to the present day ideas that the anesthetic agent, pre-existing respiratory infections, and the season of the year are of no considerable importance as etiologic agents.

It is noted that most of the complications of this series occurred in the first two days of the postoperative period. Only in those patients whose general condition was debilitated by other postoperative complications did the pulmonary condition develop late in the convalescence, and these invariably resulted in death.

The incidence of postoperative pulmonary complications was lower in this series than in most series of upper abdominal operations reported in the literature.

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SINGLE UNIT COTTON THREAD SURGICAL TECHNIC

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THE experimental and clinical investigation of Ginkovskiy[1] on the use of cotton thread as a suture and ligature material has been ably forwarded by Meade and Ochsner. These writers[2] have definitely established the advantages of cotton thread,—availability, low cost, ease of sterilization, increased strength after boiling, the lowest coefficient of wound irritation by cellular reaction, and the highest retention of tensile strength after tissue implantation. With these attributes, cotton thread challenges consideration as the best available general duty suture and ligature material. Its disadvantages are two: Initial tensile strength lower than that of catgut, linen, and silk; and the painstaking slowness of the Halsted interrupted suture and transfixion-ligature silk technic which Meade and Ochsner insist upon for cotton thread.

Size for size, the original tensile strength of spool cotton is two-thirds that of linen, three-quarters that of silk. Selection of a proportionately larger cotton size where requirement indicates is of course imperative. We have determined that a single size spool cotton thread exceeding 3 lbs. in tensile strength may be used in all except a very limited surgical field. The thread selected is No. 24 plain black spool cotton. This is tested for 3 lb. weight bearing. Doubling, trebling or quadrupling this thread provides any necessary suture strength, greater than that of the combined units, though smaller in volume than an equivalent single suture.

The Halsted technic, as originally applied to silk, confronts the surgeon with an increase in operating time of 30 to 50 per cent. For this reason, rather than reluctance to use "foreign body" material, the silk technic has only recently enjoyed a belated renaissance. We have reduced the time factor of cotton thread to that of catgut surgery, by modifying Halsted's, Meade's and Ochsner's technic in many significant points: (a) A single size thread is used, (b) continuous suture is permitted in gastrointestinal technic and in peritoneal closure, (c) the transfixion-ligature is used only when indispensable to hemostasis, (d) the number of interrupted sutures and knots is reduced by figure-of-8 stitches in fascia and by mattress figure-of-8 skin and fascia retention sutures, (e) the subcuticular or fatty tissue layer of interrupted sutures can usually be eliminated by the use of through-and-through figure-of-8 mattress skin and fascia sutures.

Preparation of Cotton Thread

As suggested by Meade and Ochsner, sterilization is effected by boiling the thread for 20 minutes. Prior to boiling, it is tested to exceed 3 lbs. breaking strength. The material is looped around a rod, a 3 lb. weight attached to a dependent 4-inch strand. Support of the weight for one minute is considered adequate. The thread is then wound about two narrow, flat wooden reels measuring 7 and

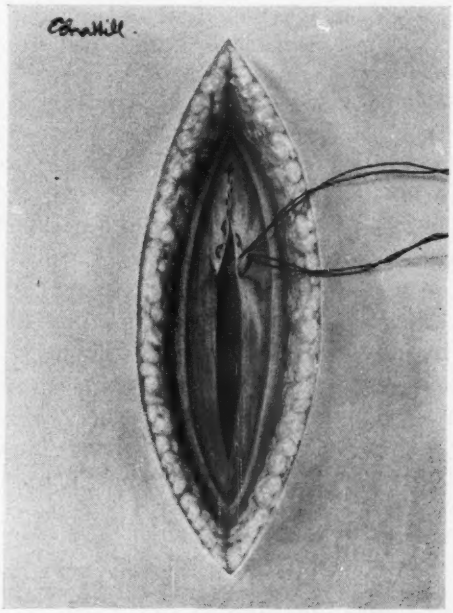

Fig. 1. Peritoneum closed with continuous suture No. 24 black cotton thread, doubled.

14 inches, and both singly and doubly around several pieces of half inch rubber tubing. After boiling the reels and rubber spools with their charges of cotton thread, the thread on the reels is cut across with scissors, creating 14 and 28 inch strands. The former are for single, the latter for double sutures. Ligatures are tied directly from the roll of cotton thread on rubber tubing which is conveniently held in the hand. Long single or double sutures are also taken from the thread rolled on tubing. The suture and ligature preparation for operation is extremely rapid and simple, with no container to open, and no material to soften and straighten. After a clean operation, the unused thread on rubber tubing is placed, still wound, in alcohol. It may be re-used up to six months or longer, after original boiling. Tensile strength should be re-tested on this once-

sterilized thread which has been kept in alcohol before re-boiling for a second operation. After preparing the sutures, they are threaded upon appropriate needles; for extensive laparotomy 12 straight skin needles should be charged.

Operative Technic With Cotton

For ligating thick pedicles, the double 14 in. thread is used; this is employed for suture-ligature in the broad ligament, ovarian and uterine arteries, in ligating the whole mesoappendix, suture of the gallbladder bed (continuous), suture of the uterus after myomectomy, hysterotomy or Caesarean section (continuous); for the outer layer of gastro-enterostomy suture the continuous double

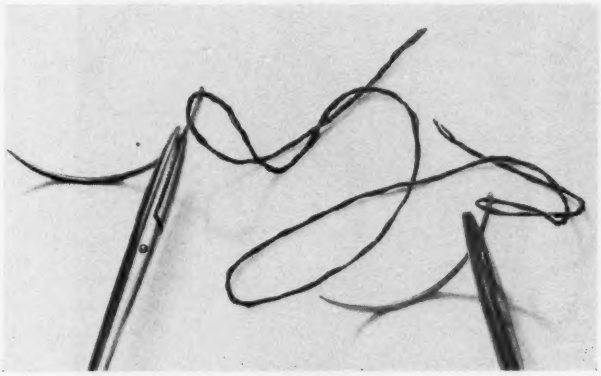

Fig. 2. Through-and-through suture of 4 strands No. 24 cotton thread, needle at each end.

thread is also used,—for the inner layer, a single continuous suture; in gastrectomy, the serosal stitch may be of interrupted double thread mattress sutures; for entero-anastomosis a continuous single strand is used for inner, interrupted or continuous single for outer layer of small intestine; interrupted or continuous double suture for seromuscular layer of large intestine. The appendix is ligated with a double thread which is repassed about the organ and ligated a second time. The inverting stitch, if used, is a single figure-of-8 which covers, but does not hermetically isolate the appendix remnant. Interrupted single cotton sutures are used for anterior and posterior colporrhaphy; double sutures to approximate the levator ani muscle fibers, and for hemorrhoidectomy. Single or double suture is employed for shortening the round ligaments; quadruple cotton thread for ventral fixation of the uterus. Bleeding points are ligated with the single strand, cut upon the knot.

An infected field is not a deterrent to the use of cotton sutures and ligatures. Healing is not delayed; cotton is less permeable to cell growth than is silk. It is therefore seldom extruded. Single No. 24 cotton thread is applicable to nerve, tendon, artery and vein suture. It can confidently be used when suture is indicated in fascial injury. We have encountered no disadvantage in using thread of a single size. In contrast to Meade and Ochsner's selection of four or five sizes from 10 to 60 for routine operative procedures, the single size or unit technic possesses obvious advantages for the en-

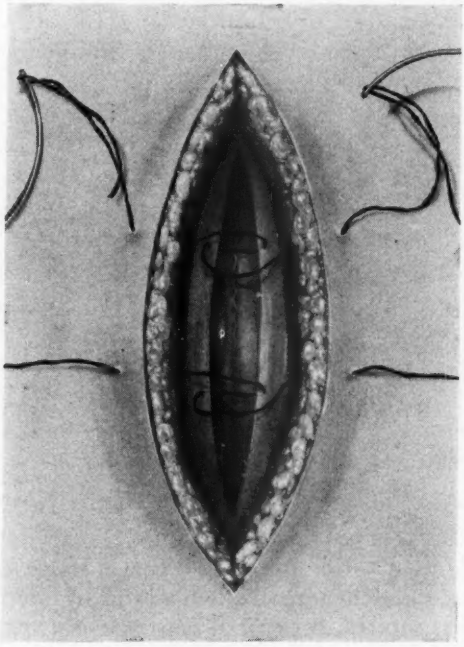

Fig. 3. Through-and-through sutures of four strands No. 24 cotton thread passed through fascia, then skin in figure 8—placed 1¼ ins. (3 cm.) apart.

tire operating room personnel. For field war use, its expediency and usefulness are especially evident.

Abdominal Closure

A continuous double cotton thread is applied to the peritoneum. When convenient the peritoneal edges are everted by a continuous mattress suture. All hemostats are removed and re-applied to still bleeding points, which are ligated. Figure-of-8 retention through-and-through sutures of quadruple cotton thread are prepared with

a needle and holder applied to each end. These are passed first through the fascial margins, then withdrawn through opposing skin edges. These figure-of-8 sutures are soft, pliable, very strong, and secure accurate approximation of skin and fascia without pressure or strangulation. They are placed 3 cm. (1¼ ins.) apart, not tied until all fascia sutures are placed. Between each through-and-through stitch is placed one single interrupted fascia suture. This is passed twice through each fascia edge, to form fine figure-of-8s. Each twice-passed fascia suture is equivalent in strength to two

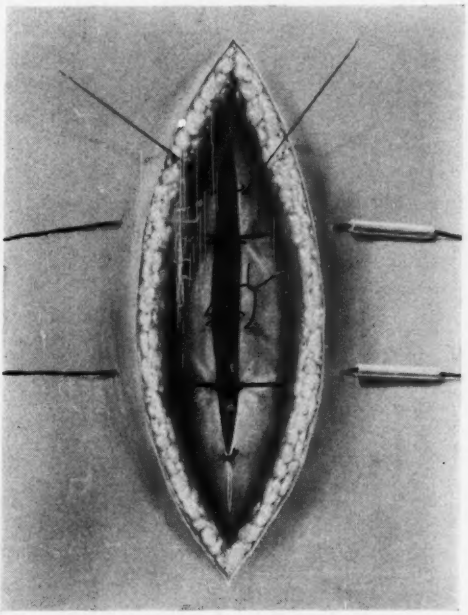

Fig. 4. Single strand No. 24 black cotton thread passed twice through fascia margin, one between each through-and-through suture.

simple sutures; the number of knots as well as sutures in fascia is thereby reduced by half. When through-and-through stitches are not used (in a small incision) the twice-passed fascia sutures should be placed at 1 cm. intervals. Each fascia stitch is tied when set. A triple throw knot is an added precaution, though probably not necessary for plain (not mercerized) cotton. The thread ends are dropped toward the lower wound angle as the sutures are tied; when all are secured the ends are lifted together and cut close upon the knot. The through-and-through sutures are now tied after passing a needle of each through a narrow belt of rubber tubing.

Interrupted single skin sutures are introduced by thrusting the straight skin needles through both skin edges. These keep the skin margins everted as they are successively pulled through and their sutures knotted. When the figure-of-8 skin and fascia retention sutures have been used, it is customary to need but a single skin stitch between each mattress suture. As the skin stitches are tied their ends are also dropped toward the lower wound angle; the line completed, they are lifted together and cut with a single scissor stroke. This wound closure is more than adequate with respect to

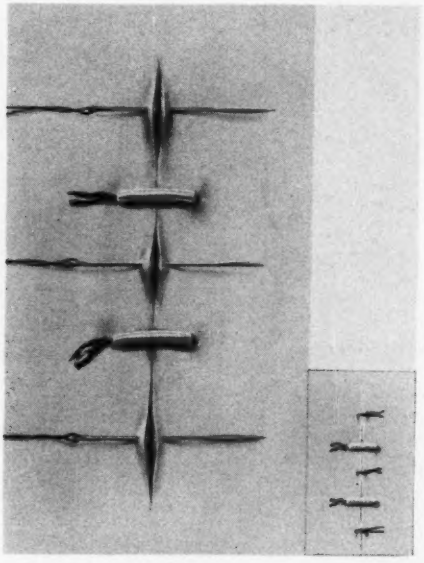

Fig. 5. Through-and-through sutures tied over rubber tubing. Interrupted skin suture of No. 24 black cotton single thread between each through-and-through.

strength; it can be done as rapidly as a conventional catgut suture. If ligatures are used only on areas that bleed after hemostat compression, we have found no disadvantage in employing the 24 cotton thread, applied as a simple ligature, without transfixion. This is an added time-saving factor. Thus far, we have not yet used cotton thread as a suture-ligature for the tonsil fossa. Probably there is no valid objection to its use for this purpose, since many bronchoscopists believe that even should so small a "foreign body" make its way into the tracheo-bronchial tree, it would not produce a significant lesion.

Experience and Results with Cotton Technic

Cotton thread is employed exclusively by us for ligature and suture. One hundred fifty major, and a large number of minor operations have been carried out with this material. Of the major group, one severe (suppurative appendix) and two minor (stitch abscess) wound infections were observed. The postoperative dressing is usually undisturbed until suture removal on the twelfth day in long, fifth to seventh days, in short incisions. The four-strand through-and-through sutures serve effectively as capillary drains of the subfascial and subcutaneous areas. There has been a total absence of serum collection in postoperative wounds. This has been the most significant and gratifying evidence of dry healing with cotton, in contrast to the wet healing associated so frequently with catgut. No foreign body tumors or unusual keloid development have been witnessed, no sutures have been expelled, disruption has not occurred; sinus formation (for 3 weeks) was seen in a single hysterectomy, in which bladder trauma probably was experienced. Patients have been agreeably surprised by the ease of removal of the soft cotton skin and mattress sutures.

Resume'

1. Technic is evolved for the use of a single size spool cotton thread for suture and ligature in the general field of surgery.
2. Modification of the Halsted silk technic applied to cotton thread enables the surgeon safely to approximate the tempo of catgut surgery.
3. Rapid, dry healing without serum formation is characteristic of cotton-closed wounds.
4. No serious limitations to the use of cotton in this manner have thus far been encountered. Its applicability to general civil surgery and to war experience is outstanding.

United Fruit Company Hospital

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THE USE OF THE HANGING CAST IN TREATMENT OF FRACTURES OF THE HUMERUS

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THE principle of this form of treatment of fractures of the humerus is very old, dating from the time physicians tied weights to the flexed elbow of the patient and allowed them to be up and about.

The method has been perfected by Caldwell[1], L. V. and H. L. Rush[2] and others[3].

I have been using this method of treatment for the past five years on my private patients and it has been the routine treatment on my service at the Louisville City Hospital. The hanging cast has been used on over 300 cases on the orthopedic service there, including different types and locations of fractures of the humerus, with 2 failures. One of these was due to "modification" of the method and one was an extensive compound fracture, in which such treatment was not indicated.

While I feel the method is simple and efficient, the patient must cooperate and he must be followed carefully throughout the treatment—that is eight to ten weeks.

TECHNIC

This is a procedure that may be done in the office under local anesthesia as a rule. The type and location of the fracture will determine how much, if any, manipulation is necessary and what type of anesthesia is required.

Oblique and spiral fractures of the humerus as well as fractures of the surgical neck with little displacement in old people, will seldom require any anesthesia or any manipulation—simply the application of the cast. Patients with displaced fractures of the neck and those requiring manipulation are given a preliminary dose of nembutal gr. 1½ and 10-20 c.c. of 1 per cent procaine hydrochloride is injected into the hematoma of the fracture. After a lapse of 10 minutes the fragments are manipulated and reduced and the cast applied. It is best to have the patient in a sitting position. Some fractures with marked displacement, and epiphyseal separations in children may require general anesthesia and even open reduction.

Compound fractures are debrided thoroughly and closed and then treated as a closed fracture with the cast. The cast may be padded or unpadded and should not be heavy.

With the patient sitting on a stool, an assistant holds the injured hand and forearm so that the elbow is in right angle flexion, or slightly less. In very fat women with large breasts, it is better to put the elbow in 60 degrees flexion.

The important point is to apply the cast so that the humerus hangs vertically with the ground, as this tends always to correct deformity and angulation. The cast is applied as high on the humerus as is possible (not necessarily above the fracture line), as this is more comfortable than a short piece above the elbow.

The forearm and hand are placed in a neutral position, with the thumb up, unless the fracture is in the lower third, when it is very important to put the forearm in pronation.

The cast extends over the wrist to the middle of the metacarpals and a small piece through the palm. The fingers and thumb are left free and use of the hand is encouraged.

A plaster loop is made in the cast at the base of the thumb, through which a narrow band is run and placed about the neck. The cast hangs *free* of the body. The farther toward the hand the sling is attached, the greater the pull of the cast on the humerus. The length of the sling is such as to allow the humerus to hang *vertically* and the hand to be higher than the elbow. No other sling is worn and the patient is warned not to rest the arm on chairs or tables. He is instructed to sleep in a semi-reclining position for the first week or ten days and put a pillow behind the arm.

Position of the fragments should be checked with x-ray after one week, with the patient in a sitting or standing position. Angulation can be corrected by the length of the sling.

The patient is encouraged to be up and about normally and let the arm hang from the neck. Active circumduction movements of the shoulder are advised after the first week. The patient stands bent forward so the shoulder is abducted, and swings the cast in a circle. This is kept up daily while the cast is worn and prevents deltoid atrophy and usually no subsequent physical therapy is necessary.

The cast is worn six to eight weeks and union is checked with x-rays before the cast is removed. Usually a sling is worn for a week following removal of the cast and as a rule the patient has almost normal motion of the elbow and shoulder after three or four weeks.

I strive for good functional results. All the reductions are not 100 per cent, but this is not as necessary as in the lower extremity,

and many of the patients with these fractures are old and will develop heart and lung complications if put to bed.

I feel that primary open reduction, bed traction, or skeletal fixation is *rarely* indicated in fractures of the humerus.

The only absolute contraindication to this form of treatment for fractures of the humerus is that the patient cannot be ambulatory or at least be able to sit up in bed.

DONT'S

Don't worry about some pain and crepitation the first week.

Don't worry that the fragments move.

Don't let the patient disturb the length of the support.

Don't apply too *heavy* a cast.

Don't neglect to see that the humerus hangs *vertically*.

Don't fail to make the patient ambulatory.

Don't allow the patient to attach the cast to the body or wear a sling.

Don't fail to start circumduction exercises of shoulder as soon as possible.

Don't fail to check with x-ray after one week with patient sitting or standing.

Don't expect the cast to reduce fractures of the surgical neck.

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PANCREATIC LITHIASIS WITH DIABETES—REPORT OF FOUR CASES

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THE pancreas, lying as it does deep in the upper abdomen, traversed in its midsection by the superior mesenteric vessels and in close proximity to the aorta and vena cava, is a structure about which until recently surgeons knew little and had little desire to learn more. Difficult of access, defying removal, and quite indispensable in the human economy, it has never in health or disease been what we surgeons fondly term a "surgical opportunity." Symptoms of pancreatic disorder range from the overwhelming, devastating and fortunately infrequent acute hemorrhagic pancreatitis to the most vague of digestive disturbances; and because there has been so little to do about it, surgeons have for the most part passed by on the other side. It has been aptly said that disease of the pancreas would be far commoner if the doctor only remembered that his patient had a pancreas. That we are becoming more conscious of such is evident from the fact that in 1932 one hundred eight cases of pancreatic stone had been reported in the literature of 265 years, and that in 1939—seven years later—204 cases were on record.

Some years ago I reviewed before the Texas Surgical Society the subject of pancreatic lithiasis and presented a case of diffuse calcification of the pancreas developing in the course of chronic pancreatitis of long duration. As was predicted at that time, this patient developed diabetes from which she ultimately died. The purpose of this paper is to write the final chapter of her illness and to report three additional cases of calcifying pancreatitis.

Report of Cases

Case 1. A child of 11 came to the Beall Clinic July 21, 1930, complaining of attacks of high epigastric pain, nausea, vomiting, loss of weight and constipation, occurring at intervals since the age of five. X-ray and laboratory studies at that time were not remarkable. The attacks increased in severity, and the patient returned in January 1933, still suffering with an attack which had begun in October previous. She sat, knees under chin, doubled up with pain, and this was her attitude whenever I saw her in the next few years. Routine laboratory tests were negative except for the significant observation of a number of undigested muscle fibers in the stool. X-ray showed the entire pancreas outlined by innumerable small calculi. Exploration of the abdomen revealed marked enlargement of mesenteric lymph nodes and engorgement of mesenteric vessels. An extreme grade of cecum mobile was noted. The pan-

From the Beall Clinic.
Presented before the Texas Surgical Society, Oct. 8, 1940.

creas was enlarged, hard and nodular, and crepitant with concretions. Later the pancreas was carefully explored, but removal of the calculi was impossible. Biopsy showed interstitial pancreatitis with dense and extensive fibrous tissue infiltration and calcification in both fibrous and epithelial structure. Islets of Langerhans were few and far between.

In June, 1933, a glucose tolerance test showed evidence of pancreatic insufficiency. In April, 1934, urine and blood sugar were still normal, and the blood calcium was 7.5 mgm. per 100 c.c. In November, 1934, on account of severe pain, the pancreas was again explored. Wirsung's duct was opened and its patency was established by a hemostat introduced into the duodenum. A few small stones were removed from the duct. In March 1935, glycosuria appeared, and in November 1935, urinalysis showed heavy sugar, acetone, and

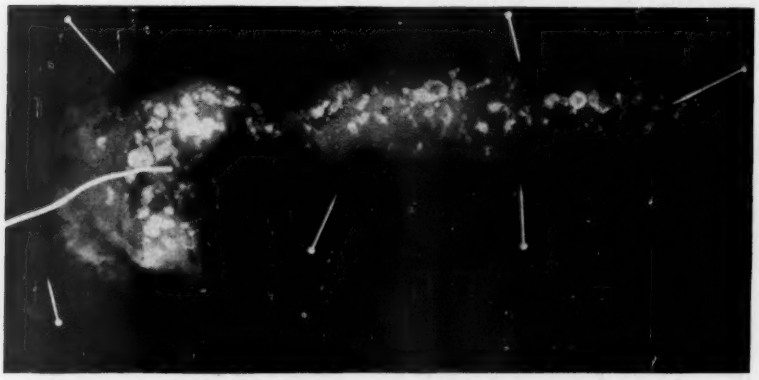

Fig. 1. X-ray of pancreas, showing stones, autopsy specimen. (Case 1.)

diacetic acid. Attacks of pain became increasingly severe and prolonged. In 1939, the patient was taking 60 units of insulin daily. She steadily declined, and in September, 1939, died of infection from a hypodermic injection.

Notable autopsy findings were emaciation, the small fibrotic pancreas filled with stones, some in the duct and others in the gland substance (fig. 1), and a tremendously dilated colon filled with fecal matter the consistency of soap. Chemical analysis of one of the calculi showed it to consist entirely of calcium carbonate. Microscopic sections of the pancreas (fig. 2) showed fibrous tissue, with no acini and very few islets, and varying-sized calcium particles throughout.

Comment: Striking features of this case are the early age of onset, chronic pancreatitis of long standing with development of calcification between 11 and 14 years of age; futility of surgical treatment; appearance of diabetes at 16, ending in death at 20—with almost complete destruction of the pancreas. Intractable high epigastric pain was the outstanding symptom.

Case 2. A white woman, aged 37, was admitted to St. Joseph's Hospital Jan. 19, 1938, complaining of weakness and loss of weight, headache, epigastric pain of five years' duration, and insatiable appetite. Examination showed

epigastric tenderness, glycosuria, and a blood sugar of 333 mgm. per 100 c.c. There was a history of jaundice twenty years before. Further x-ray studies in October 1939, showed the stomach and gallbladder normal, with numerous concretions outlining the pancreas (fig. 3). Her complaint at that time was

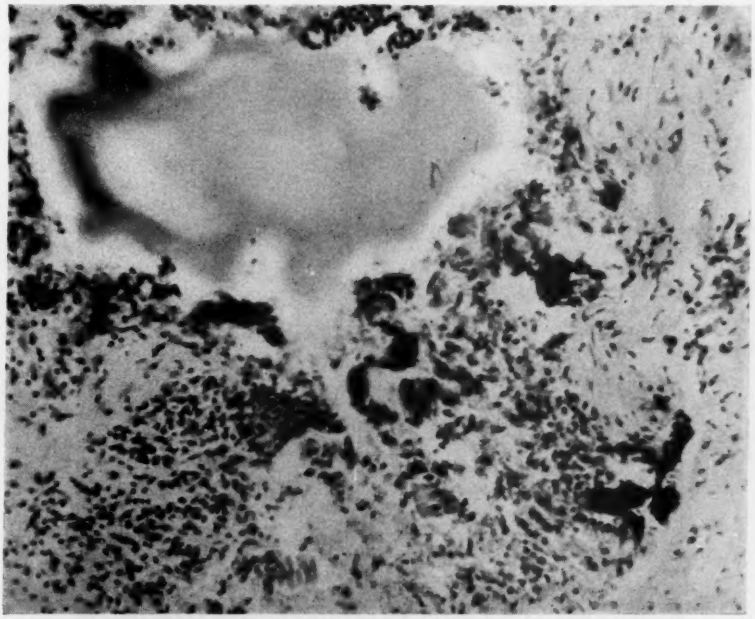

Fig. 2. Photomicrograph section from pancreas autopsy specimen, case 1, showing absence of acini, marked fibrosis, and calcified areas.

loss of weight, with epigastric pain, sharp, knife-like and severe. The diabetes was being controlled by diet and insulin.

Comment: The history of jaundice twenty years previous with epigastric pain five years prior to 1938 indicate chronic pancreatitis, with calcification of entire pancreas, and diabetes.

CASE 3. A physician, aged 38, was admitted to the Cook Hospital in August 1932, complaining of severe epigastric pain of sudden onset. At operation there was definite evidence of acute pancreatitis. He was well until June 1939, when he had another attack of severe epigastric pain which lasted about two weeks. Following this attack of pancreatitis he was well for several months, but during the past ten months he developed almost constant epigastric pain with marked loss of weight and strength, and symptoms of mild diabetes. X-ray examination June 1939, showed evidence of pancreatic stone (fig. 4). The gallbladder was normal. Because of the continued pain and disability and the onset of diabetes, an operation was performed in hope that the calculi could be removed and the pancreatitis arrested. The head of the

pancreas was irregular and hard with calcified nodules scattered through the gland substance. The tail was small and soft. The stones could not be removed, but a small piece of tissue containing concretions was excised for study. The pathologist's report is worth quoting here: "Microscopic sections show fibrous tissue that varies in density and in which a few small, atrophied tubu-

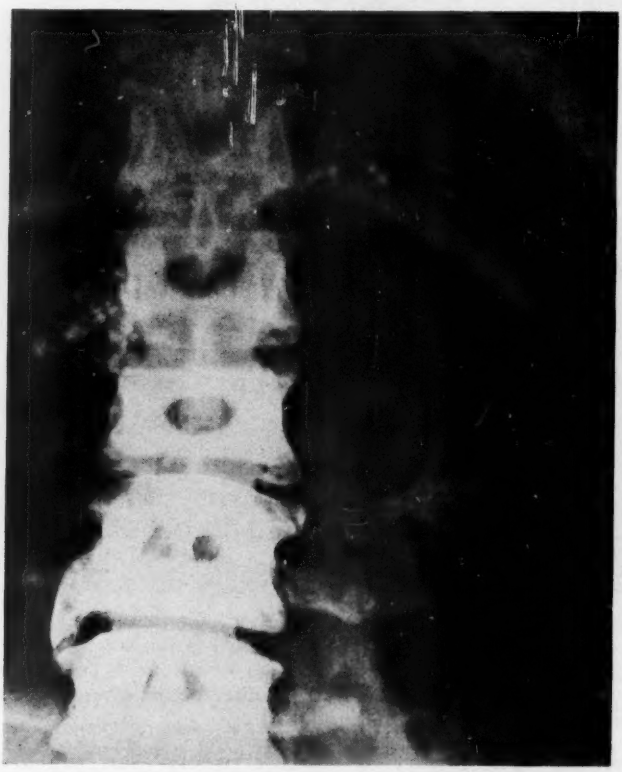

Fig. 3. X-ray of pancreas, showing diffuse calcification. (Case 2.)

lar spaces are seen. . . . There are small, circumscribed areas that show myxomatous degeneration and large irregular deposits of calcium. A large part of the fibrous tissue is poor in cell nuclei. No islets of Langerhans are seen in sections from this tissue." After a stormy convalescence this patient is remarkably improved, eats normally, has no diabetes, but notices copious stools typical of pancreatic insufficiency.

Comment: In this case two attacks of acute pancreatitis seven years apart preceded the development of chronic pain, loss of weight, and mild diabetes. Calcification was noted at the time of the second attack. Remission following operation was probably the

result of incision and drainage of the tense head of the pancreas with subsequent improvement in circulation and function.

CASE 4. A physician, aged 59, was admitted to the Cook Hospital Dec. 10, 1938, complaining of constant and severe epigastric pain of four days' dura-

Fig. 4. X-ray of pancreas, showing stones. (Case 3.)

tion. He gave a history of similar pain on previous occasions. In December 1935, he had an attack that was diagnosed pancreatitis. Subsequently he was operated on twice in other clinics with no relief. Examination on admission showed an acutely ill patient, in great pain, with marked epigastric tenderness. Urinalysis was negative. X-ray (flat plate) of the abdomen showed numerous faint stones throughout the pancreas. On account of the intractable pain operation was reluctantly undertaken. No definite stones were found. The pancreas was hard. There was marked edema of the fascia overlying its midsection where a definite constriction of the gland was evident. It was almost pinched in two. The fascia was divided in the long axis of the pancreas and the operation terminated. Following this the patient was completely relieved of the agonizing pain. He has remained well and has had no glycosuria at any time.

Comment: This is a case of recurring pancreatitis with calcification of the pancreas of moderate extent. Relief was brought about by relieving a stricture of the midsection of the gland.

Discussion

Recently Haggard and Kirtley[3] published a brief but comprehensive review of the 204 reported cases of pancreatic lithiasis, including the first case reported here. Sixty-five of these had been operated on, 110 were found at the autopsy table, and 28 cases had been diagnosed by x-ray without operation. The mortality of the operative cases was 18.4 per cent. Stones were removed in 58 of the 65 cases. Glycosuria was noted in 9.2 per cent of the sixty-five. Outstanding symptoms in the series were severe mid-epigastric pain, vomiting, loss of weight, jaundice, and steatorrhoea.

It is apparent from a study of these 204 cases that pancreatic lithiasis is of two types. In the one type, one or more stones are formed in the larger ducts, just as kidney stones form in the renal calices, causing attacks of severe pain with long remissions during which the patient may be quite comfortable. There is little history of chronic pancreatitis and little damage to the pancreatic parenchyma unless obstruction of Wirsung's duct is complete and prolonged. Diabetes seldom complicates the picture. The stones are amenable to surgical removal and recovery is the rule. This type is the true pancreatic lithiasis and, fortunately for us, includes the majority of all the cases reported.

The other type, so well illustrated by the four cases here presented, is in reality a calcifying or lithiasic pancreatitis. The picture is one of chronic pancreatitis beginning, as we have seen in cases 1, 2, and 4 long before the formation of calcareous deposits could be demonstrated, and causing extensive destruction of the parenchyma of the gland including the islets of Langerhans. The normally cellular pancreas becomes a fibrotic organ of impaired function and lowered vitality. Calcification is the next step, and its extent depends on the extent of the pancreatitis. The calculi form in the interstitial tissue as well as in the tiny ducts. Surgical removal is out of the question, but there is evidence in two of our cases that incision into the capsule of the diseased gland was followed by prompt remission of symptoms. Diabetes is more apt to develop in this type because of the greater destruction of pancreatic tissue. It was present in three of our four cases, and in case 3 disappeared after operation. In case 4 the calcified areas seen in x-ray were few and

faint, and no glycosuria was noted at any time. In cases 1 and 2 with calcification of the pancreas from head to tail the diabetes was present and persistent.

The incidence of diabetes in the 65 surgical cases reviewed by Haggard and Kirtley was 9.2 per cent. A careful follow-up of the survivors would doubtless increase this figure materially. The frequency with which diabetes follows acute pancreatitis has been the subject of a careful study by Shumacker. He concludes that that disease is a result of acute hemorrhagic pancreatitis in at least 2 per cent of the cases and that 3 to 10 per cent of individuals surviving such attacks (35 per cent mortality) eventually become diabetic.

In a discussion of pancreatic lithiasis it is well to consider briefly the phenomenon of calcification. The tendency throughout the animal kingdom for calcium salts to be deposited in dead, dying, or disabled tissue has long been known. Renal damage results in kidney stone; aortitis is followed by arteriosclerotic plaques; the deceased but undelivered fetus becomes a lithopedion; and pancreatitis in time produces calcification of the pancreas. The most likely explanation of this is the theory accepted by most physiologists that calcium is held in solution in the body by a certain concentration of carbon dioxide (1:10000). In tissues of lowered vitality function is impaired and metabolic activity slows down. The CO_2 content is correspondingly diminished, and this lowered CO_2 tension brings about the precipitation of calcium. Randall has proved that the beginning of a kidney stone, be it phosphate, oxalate, or urate, is a tiny plaque of calcium carbonate. All pancreatic stones are calcium carbonate. Apparently nature, like man, erects monuments of marble over cells that have ceased to exist.

It is reasonable to assume that localized damage to a pancreatic acinus might eventually form a stone with pancreatitis as a secondary development. It is interesting to note that in three of our cases there is definite proof by negative x-rays that chronic pancreatitis preceded by years the calcifying process. The cause of pancreatitis is usually a matter of conjecture. In two of our cases the history of alcoholism was suggestive. In the other two—those with marked diabetes—there was no history of gastronomic excesses.

In none of the four cases here presented was there any evidence of disturbed calcium metabolism, but Brooke reports a case in which it seemed to be a factor in the production of pancreatic calculi. A man of 67 suddenly developed attacks of pancreatic colic. X-ray examination showed diffuse calcification of the pancreas (as in case 1 and 2). At 16 and 43 he had had severe giant urticaria persisting for months and associated with annoying indigestion. Exami-

nation then showed evidence of calcium deficiency, and he was given large doses of calcium chloride with immediate and complete relief. For eight months or more he took 90-100 grains of calcium lactate daily and continued the dose at intervals for four or more years. He was well for twenty-five years when he suddenly developed pancreatic colic. After a few months the attacks ceased and did not recur during the nine years the patient was under Brooke's observation. Brooke advances proof that a sudden increase in the calcium content of the blood of animals is followed by a 30 per cent increase of calcium in the pancreatic juice, and he suggests that such an increased concentration in the pancreatic ducts might lead to the formation of calculi. The case is interesting from a speculative viewpoint. Pancreatitis was not clinically present; there was no evidence of pancreatic insufficiency; and the x-ray of the pancreas at 76 showed no more calcification than was noted at 67.

It is generally agreed that the treatment of pancreatic lithiasis is surgical except in cases of calcifying pancreatitis such as the four presented here. Removal of the stone or stones is a sound and practical procedure when they are in the larger ducts. The operative approach will vary according to the location of the calculi. When the main lesion is in the head of the gland, the method advocated by Sistrunk of mobilizing the duodenum, reflecting it medially, and approaching the pancreas from behind as well as through the gastrocolic omentum, is deserving of earnest consideration. In the three of our cases which were operated upon we failed to remove the calculi. Disappointing as this may be, operation in such instances is justified if the symptoms are severe enough to demand exploration. Gratifying relief may ensue, as in two of our cases, from the improved circulation incident to exposing and exploring the pancreas.

When the pancreas has been largely destroyed and replaced with fibrous tissue, the symptoms of the resulting pancreatic insufficiency may be materially relieved by medical treatment. The diabetes, of course, may be controlled by diet and insulin. There is evidence that the preparation lipocaic, the fat metabolizing extract from the pancreas (Dragstedt), may be useful in improving and perhaps also in preventing the fatty degeneration of the liver that frequently accompanies destructive lesions of the pancreas.

SUMMARY

The subject of pancreatic lithiasis is briefly discussed. Four cases of calcifying pancreatitis are reported, in three of which diabetes was present.

1212 W. Lancaster

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THE RICHMOND POSTGRADUATE SURGICAL ASSEMBLY

The Southeastern Surgical Congress will convene in Richmond, Virginia on Monday, March 10, 11 and 12, for a three-day session. Richmond as a city is replete with historic interest and possesses a charm all its own, assuring those in attendance upon the meeting of congenial and inspiring surroundings. This, the twelfth annual assembly of the Congress, is another milestone on the educational path it has chosen to follow. The greatest asset possessed by the medical profession is the constantly accumulating fund of knowledge in the minds, in the literature, and in the tradition of its members. The responsibility for the acquisition of this lore rests solely on the profession: its dissemination, while participated in to some degree by a few worthwhile lay bodies, is also a responsibility of the profession. A potent means of accomplishing this purpose lies in graduate assemblies in which are discussed the newer thoughts and concepts, the discoveries, the improvements in technic and treatment, and the confirmation of methods which have been tested in the crucible of experience. Doctors attend these meetings with one objective, that of improving their ability to render good service. They find their remuneration in a consciousness of service, in the approval of their confreres, in the gratification of their scientific curiosity and in the satisfaction that comes from participation in the addition to the common fund of knowledge from which all may draw. The list of those who are to lead the discussions at the coming session of The Southeastern Surgical Congress is a sufficient guarantee that these will be replete with information in reviewing the newer ideas in surgery and its related fields, serving as a refresher course to those whose interest lies in this sphere. The offi-

cers of the Congress urge upon its members the advisability of their attendance and extend to such physicians as may be interested a cordial invitation to be present.

IRVIN ABELL, M. D.
President

MUSCLE CHANGES IN INFANTILE PARALYSIS

For years physicians have been aware that muscle tissue becomes flabby and atrophied after the paralytic phase of anterior poliomyelitis. They have also known that the muscles of a paralyzed patient should be protected by corsets and splints to prevent the development of contracture deformities. Only recently, however, have the details of poliomyelitis treatment been explained on the basis of the changes in muscle. Hipps has recently made an interesting study of the pathologic lesions in paralyzed muscle with a grant from the National Foundation for Infantile Paralysis in which he has reported many discoveries.

According to Hipps, muscle atrophy in poliomyelitis is manifested in several different ways. In some instances the muscle cells atrophy and degenerate uniformly throughout the entire muscle group. In others a whole muscle is replaced by fibrous or fatty tissue. In still others patches of degeneration appear scattered throughout an otherwise normal muscle. Since his examinations of gross structure reveal that degeneration is most often produced at points subject to undue longitudinal strain it is plain to see that if paralyzed muscles are left unprotected they are very likely to receive irreparable damage. On the other hand, if a weak group of muscles is protected to prevent longitudinal strain, certain sections of the muscle may be so little damaged that they will return spontaneously to fairly good function or be suitable for reconstructive operations later.

Our conceptions of the lesions in paralyzed muscle are hereby clarified and we are reassured of the advisability of external splinting to prevent undue strain. Furthermore, this makes plain the explanation of varying degrees of weakness and atrophy which is so typical of poliomyelitis. Hence we now understand why spontaneous recovery of a muscle can take place many months after the initial paralysis. Orthopedic surgeons have known for a long time that reconstructive surgery in poliomyelitis should not be undertaken until eighteen or twenty-four months have elapsed after the time of the acute attack. Their arguments for caution and conservatism have been buttressed by this wholly adequate analysis of the muscle changes following infantile paralysis.

WALTER G. STUCK, M.D.

RICHMOND!

Historic, beautiful, cultural, hospitable Richmond! One of the most colorful cities of the South, the home of a people valiant and proud, where courtesy and friendliness are traditional. This year the gates of this old city will be opened to the members of the Southeastern Surgical Congress. Upon the invitation of the medical profession of Richmond and Virginia, the Congress will be privileged to revel in its historic lore, to enjoy its beauty and culture, and to partake of its delightful hospitality.

One cannot resist the spell which Richmond weaves. Although spreading today over its seven hills a busy industrial, financial and educational center, among its towering structures one senses much of the charm of bygone days. In virtually every quarter may be found relics of the past, reminders of the dramatic part played by the city in the making of the nation. Members of the Congress will want to visit every one of these historic shrines, especially St. John's church, in which Patrick Henry, in 1775, uttered his immortal protest against British oppression, "Give me liberty or give me death;" the old Capitol building, wherein Aaron Burr was tried in 1807, and the Secession Congress was held in 1861; the White House of the Confederacy, the home of Jefferson Davis during the four bitter years of the Civil War; and the home of General Lee and of John Marshall. All these and more still stand, bearing witness to the patriotic zeal and the indomitable spirit of the Virginia people.

Of particular interest to members of the Congress will be the Medical College of Virginia, one of the first medical schools in the South. The oldest building of the College, a splendid example of Egyptian architecture, was erected in 1845, while the college was still a part of Hampden-Sydney University. For many years within its walls were carried on the activities of the entire medical school. Today, it is only one of a number of fine buildings, the newest among them being the twenty-story Medical College Hospital and Medical Center. Members of the Congress should, by all means, inspect this institution, which is probably the most complete in the country in equipment and service.

The Congress may be sure that the surgeons of Richmond will extend a gracious welcome and provide for us an enjoyable three days' sojourn. To be entertained in the true Virginia manner is an experience which visitors there long recall. From this standpoint alone, the trip will be well worth while.

From the scientific standpoint also, the meeting this year will be unique, in that it will be full of profit and of unprecedented portent. During the past twelve years the Congress has continued to go for-

ST. JOHN'S CHURCH

It was in this little white church, erected in 1741 and the oldest church in Richmond, that Patrick Henry delivered his immortal "Liberty or Death" oration. In the churchyard is a cemetery containing the graves of many famous people, including Elizabeth Arnold Poe, mother of Edgar Allan Poe, and George Wythe, professor of the first law course offered in America.

ward in pursuance of its original plan of carrying surgical science to the remotest regions of our Southland, and to promote by educational methods the advancement of surgery in this section. Now, at the beginning of 1941, *our association is confronted with the need of even more earnest endeavor, not only that it may better serve our immediate territory, but that it may fulfill a mission of far greater scope.*

The recent events in Europe have brought to a culmination a trend of affairs which for several years has gradually been gaining ground. Formerly, our institutions had little to offer in the way of higher medical and surgical training. Scientific investigation was centered chiefly in a few European cities, and it was the custom for Americans to go abroad for advanced study. During the past two

or three decades, however, the picture has been changing. More and more, American teaching has featured postgraduate instruction. Postgraduate clinics and research foundations which provide unsurpassed advantages have been organized in the medical centers throughout our own country. Since the beginning of hostilities in Europe, medicine and surgery there have practically come to a standstill, and as a consequence, the world is now looking to us for leadership in these fields. America has been placed in the spotlight. Further scientific development rests with our institutions and our associations. They hold the key to future progress.

New $2,500,000 Hospital of the Medical College of Virginia, Richmond, with Nurses' Home in foreground and some of the other 17 buildings of this Medical Center in the background.

This new situation presents to our members an obligation to put forth their best efforts, that our association may contribute its share in fostering America's preeminence in professional achievement. Fortunately, the Congress was founded at the right time to grow into usefulness when most needed—now! It is today a smoothly functioning, powerful unit, and through its membership of surgeons from eleven states, through its journal, its state sectional meetings, and particularly through its annual meeting, it is now in a strategic

position to exert a strong influence in the surgical affairs of the nation.

No one can question the superior ability of our members as surgeons, nor can one deny that, as teachers, many of them have no peers. The fruits of their efforts in both respects are evidence enough of these facts. The excellence of our journal, THE SOUTHERN SURGEON, *is accepted abroad as well as at home. As the official publication of the Texas Surgical Society and the Southeastern Surgical Congress, it carries the wealth of Southern surgery to the four corners of the earth. The affiliation of the two associations in the use of the* SURGEON *was indeed a wise one; by thus joining forces, they have provided a monthly outlet for their productions and have gone far toward strengthening the prestige of Southern surgery.*

In conformity with the new movement toward higher scientific training, the annual meetings of the Congress are designed to afford a postgraduate course in the newest and best in surgery. Each year, in addition to numerous timely papers by members, an impressive series of addresses are delivered by several distinguished guests, representing practically every surgical specialty. Particularly should the younger members of the Congress take advantage of this privilege. In fact, it is chiefly for their benefit that the programs are arranged, that they may keep informed and be better equipped to meet the present need. Judged by its instructive merit, the program this year is outstanding, and in the brilliant array of authoritative papers promised every member will find much valuable information to enrich his store of scientific learning.

Never has the annual meeting of the Congress beckoned more invitingly than this year. Never has a full attendance been more urgent. The opportunity is irresistible, the obligation profound. Make your plans now to join the March to Richmond in March!

R. L. SANDERS, M. D.

BOOK REVIEWS

The Editors of THE SOUTHERN SURGEON *will at all times welcome new books in the field of surgery and will acknowledge their receipt in these pages. The Editors do not, however, agree to review all books that have been submitted without solicitation.*

FRACTURES AND DISLOCATIONS FOR PRACTITIONERS. By EDWIN O. GECKELER, M. D., Fellow of the American College of Surgeons, Fellow of the American Academy of Orthopedic Surgeons, Diplomate of the American Board of Orthopedic Surgery. Second revised edition. 314 pages, with 267 figures, including 131 x-ray pictures. Price, $4. Baltimore: The Williams & Wilkins Company, 1940.

This is one book which adheres closely to its title and does not ramble away into the author's pet fields of interest. As it plainly states, the book is intended to be a handy reference work for the general practitioner who is called upon to treat any ordinary fracture or dislocation. Of necessity the chapters are brief and concise and no effort is made to give a detailed description of treatment for each fracture. No words are wasted and no needless illustrations clutter the book. Consequently every sentence is full of meaning and every statement merits attention.

In the first part of the book much well-advised explanation of fractures in general is given with special emphasis on industrial accidents and determination of extent of disability. The medico-legal angle in fracture treatment is discussed adequately yet without too much emphasis. The importance of general physical signs and symptoms and the dangers of overlooking other trauma is well brought out.

Details of first-aid splinting and supportive care are outlined as well as thorough explanations of the way to apply casts to various parts of the body. These points are clearly presented by diagrams and excellent photographs. A whole chapter is devoted to ingenious methods of exercising various joints during the recovery stage.

In the chapters on treatment of fractures I found three debatable statements in an otherwise excellent summary. When the author says of fractures of the jaw, "never assume the treatment of a fracture which has occurred during extraction for which the dentist is responsible," I think he is timidly evading an obligation on doctors to render aid when they can. In discussing fractures of the spine he says "it is a serious mistake to tell the patient in so many words that he has a 'fractured spine' . . . and let him understand that no further support will be necessary after the removal of the cast." Patients, especially industrial workers, are quick to suspect subterfuge and consequently mistrust a surgeon who is not straightforward. Moreover fractures of the spine usually require support by brace or corset many months after the cast is removed. Lastly Figure 142 demonstrates a plaster spica cast for fracture of the hip with the fractured leg externally rotated. According to all the best authorities it is extremely important that the affected leg should be rolled inward in order to lock the fragments.

Except for these three errors or oversights one can readily endorse every statement in the book. An enormous field of surgery is covered by a small volume which is an invaluable aid to anyone doing fracture work.

—WALTER G. STUCK, M. D.

GYNECOLOGICAL AND OBSTETRICAL PATHOLOGY. WITH CLINICAL AND ENDOCRINE RELATIONS. By EMIL NOVAK, A. B., M. D., D.Sc. (Hon. Dublin), F.A.C.S., Associate in Gynecology, The Johns Hopkins Medical School; Gynecologist, Bon Secours and St. Agnes Hospitals, Baltimore; Fellow, American Gynecological Society, American Association of Obstetricians, Gynecologists and Abdominal Surgeons and Southern Surgical Association; Honorary Fellow, Royal Institute of Medicine, Budapest; Sociedad d'Obstetricia et Ginecologia de Buenos Aires; Central Association of Obstetricians and Gynecologists; Texas State Association of Obstetricians and Gynecologists; Past Chairman, Section on Gynecology and Obstetrics, American Medical Association. 496 pages, with 427 illustrations. Price, $7.50. Philadelphia and London: W. B. Saunders Company, 1940.

Here is a scientific book, well planned and well written, by a master gynecologist and obstetrician. His idea was to fulfill "the composite needs of the student, practitioner, specialist, and pathologist in this particular field." Thus it is a middle course between being superficial and encyclopediac.

The diseases of the female genital tract are covered thoroughly, from below upward, with main emphasis on gross and microscopic pathology. Following the trend of most good textbooks of pathology, enough clinical data are furnished to make the subject clear and complete.

The author has a way of impressing important statistics upon you without boresome references, citations, and tables. By this means he maintains good balance, giving each subject the emphasis it deserves, which is valuable in diagnosis and prognosis. The cyclical changes of the reproductive organs are described, so that the normal histologic and endocrine physiology are pointed out before pathologic lesions are presented. The book abounds in photomicrographs, which are better than words.

The section on ovarian tumors is one of the high spots, and covers the difficult subject exceedingly well.

CLINICAL PELLAGRA. By SEALE HARRIS, M. D., Professor Emeritus of Medicine, University of Alabama, Birmingham, Alabama. Assisted by SEALE HARRIS, JR., M. D., Formerly Assistant Professor of Medicine, Vanderbilt University, Birmingham, Alabama. With foreword by E. V. MCCOLLUM, Ph.D., Sc.D., LL.D., Professor of Biochemistry, School of Hygiene and Public Health, The Johns Hopkins University, Baltimore, Maryland. With nine collaborators. 494 pages, with 66 illustrations and 4 color plates. Price, $7.00. St. Louis: The C. V. Mosby Company, 1941.

To call this book simply Clinical Pellagra is an understatement—it is more an anthology or encyclopedia of pellagra. Dr. Harris is an expert on the subject himself, but he calls in nine other experts for collaboration in writing the book. Besides these he gives a complete but brief story of all the more important men and ideas contributing to the study of pellagra since its inception.

The treatise begins with a review of pellagra in Europe and the United States, and a review of practically all the theories of etiology, carrying these through logically and faithfully up to the present status. He quotes and comments, and evaluates a tremendous material, assembling probably the best history of pellagra yet done.

In the etiology and pathology as he discusses it, he rescues us from the tendency to over-simplify pellagra as a nicotinic acid deficiency. The real cause for

deficiency is often in the stomach and liver. An excellent chapter deals with the relation to pernicious anemia and sprue.

The important work being done at the University of Georgia and at Duke University is described by the principal workers themselves, Dr. Sydenstricker and Drs. Ruffin and Smith, respectively. Other contributors have chapters on treatment with an anterior pituitary extract, pellagra in childhood, and the heart in endemic pellagra.

Finally the sections on symptomatology, diagnosis, prognosis, prophylaxis, and treatment need no other comment than that they are the most authoritative up to this date. Descriptions are clear, and illustrations are numerous. Type is large and readable, and the book is broken down into small sections with black print headings and convenient summaries.

There is much more to pellagra than nicotinic acid—the end of the story is not yet told. You ought to read this book and know more than you do about this disease so important in the South, and about the laudable work done by Southern doctors in solving the problem.